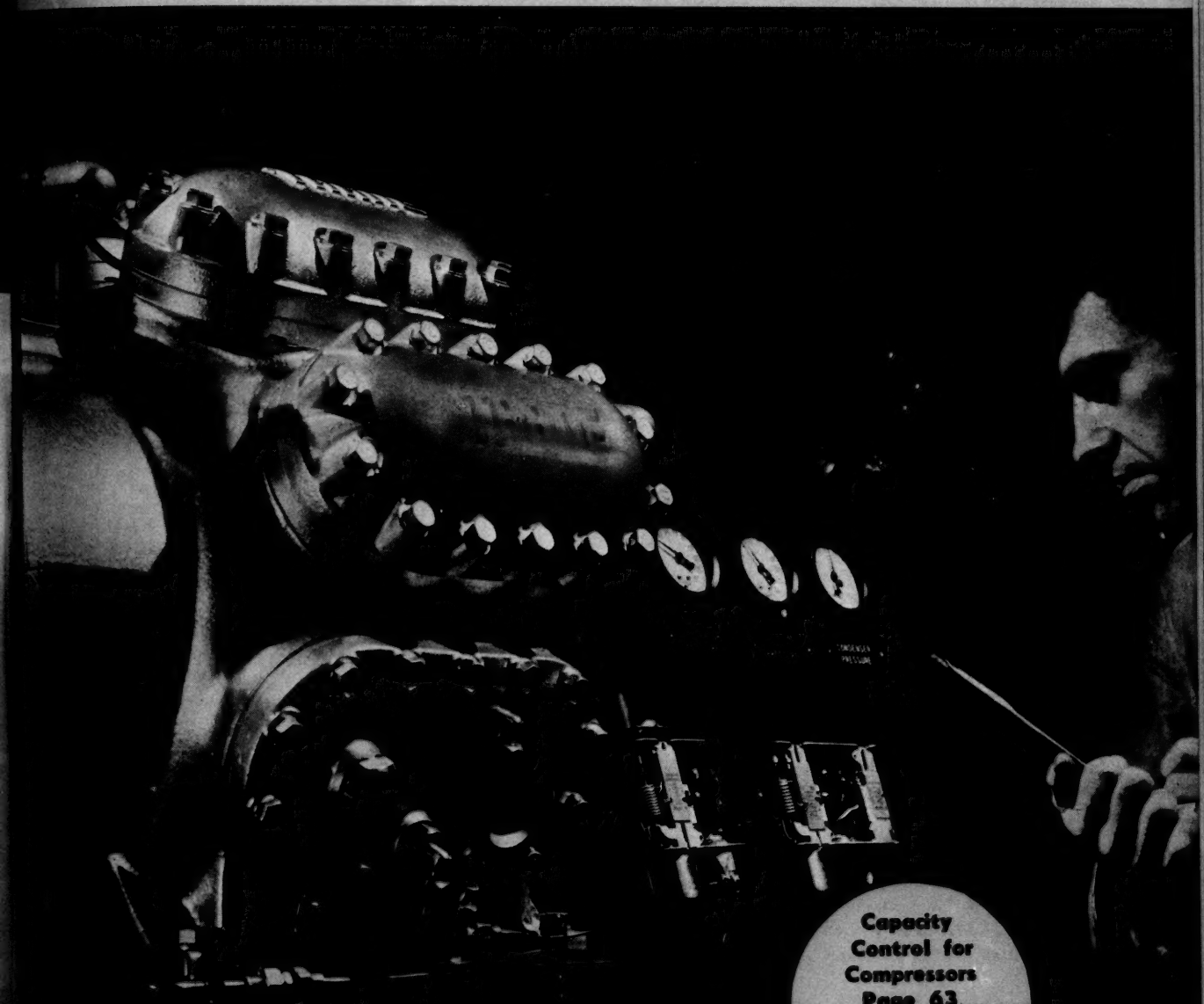
DECEMBER, 1954—51st YEAR

HEATING AND VENTILATING

INCLUDING AIR CONDITIONING – PIPING – REFRIGERATION – AIR SANITATION



Capacity Control for Compressors Page 63

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NO OTHER STEAM TRAP

gives you all these features for Low Pressure Heating Service!

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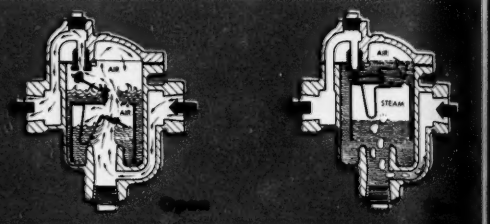
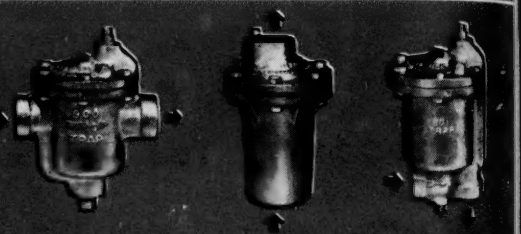
Use of a "blow" bucket with auxiliary thermostatic vent gives maximum air-handling capacity. Air and water blow straight through until steam closes vent.



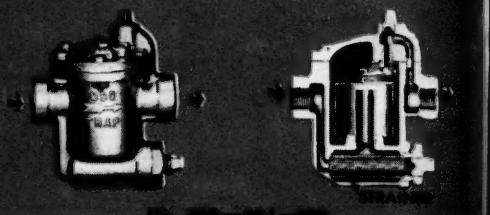
2. EASY INSTALLATION

Any pipe connection—horizontal, vertical or angle—available for the majority of installations to save time, labor and fittings.



3. INTEGRAL STRAINER

The three most commonly used trap sizes are available with strainers built-in to the body to save time, labor and money through faster installation with fewer fittings.



4. STAINLESS MECHANISM

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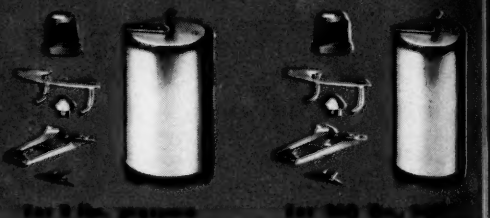

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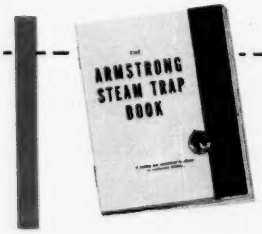

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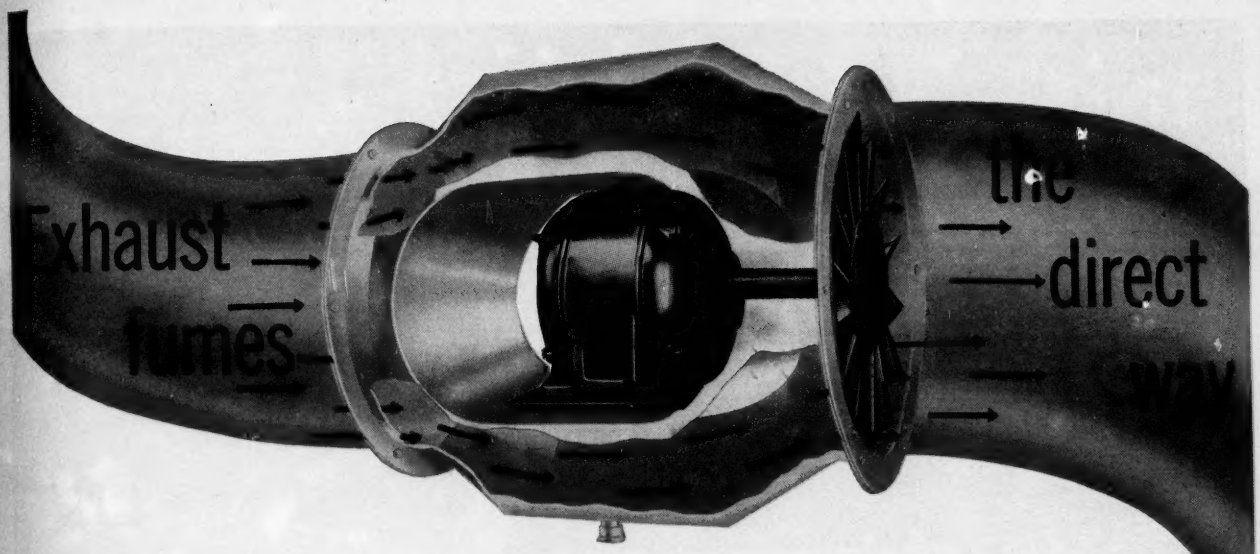
—the Armstrong Steam Trap Book gives complete data and prices, tells what size trap to use.

ARMSTRONG STEAM TRAPS



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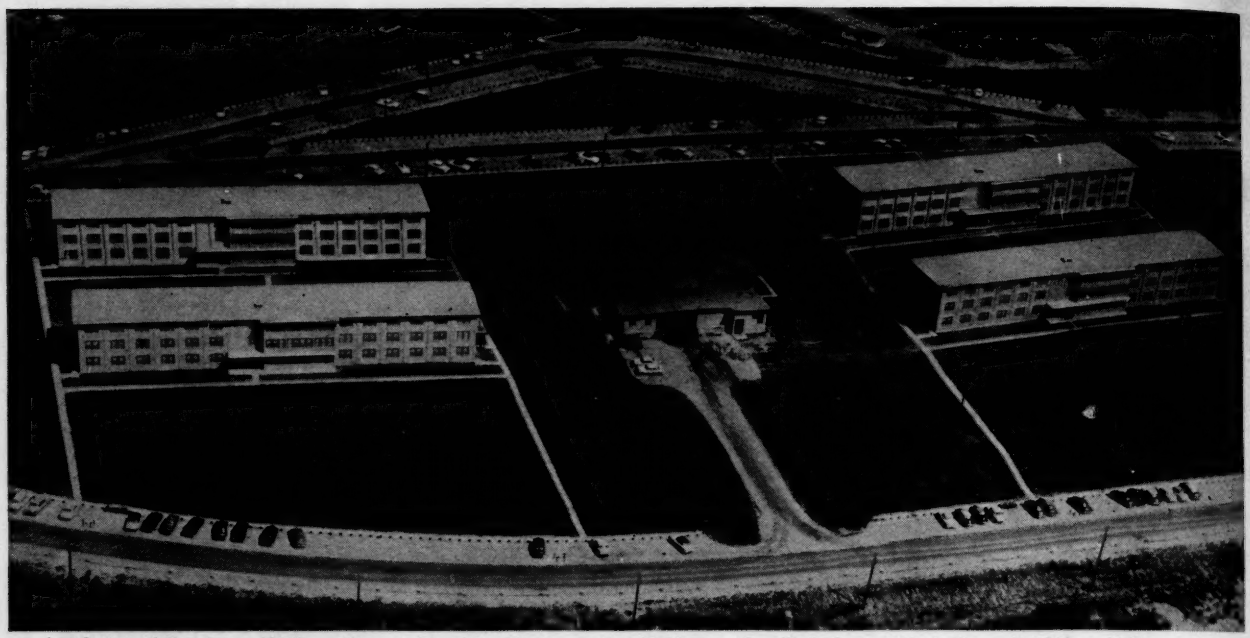
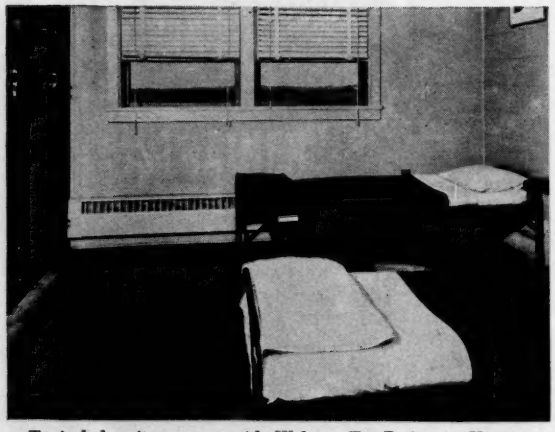
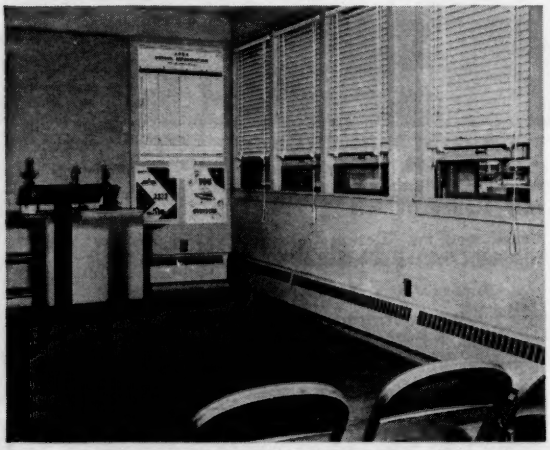


Aerial view of Grandview AF Base, Missouri. Consulting Engineers: Guy B. Panero, New York (basic design); Burns & McDonnell Engineering Co., Kansas City (GAFB modifications). Heating Contractor: ELUS Corp., Kansas City. General Contractor: Chambers-Tarbell, Kansas City.

2½ MILES OF HEATING COMFORT for Grandview AF Base...



Typical dormitory room with Webster Tru-Perimeter Heating with Webster Walvector along exposed walls.



Lounge-day room fitted for use as lecture room. Note Walvector beneath window area.

Modern airmen's dormitories with forced hot water Webster Tru-Perimeter Heating provide more space, more privacy, more comfort — all objectives of the U.S. Air Force when they built ten new dormitories at Grandview, Missouri.

For heating comfort, nearly 2½ miles of Webster Walvector circle the exposed walls . . . create a blanket of clean, gentle, even warmth . . . end cold spots, hot spots and drafts. Heating element and piping are concealed in trim metal enclosures.

New, modern housing has been recognized as essential in maintaining efficiency of career airmen. At Grandview, Webster Tru-Perimeter Heating contributes to airmen's comfort.

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HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, PLUMBING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS

DECEMBER, 1954

VOLUME 51 – NO. 12

The Cover: Tabulating performance of a compressor. Photograph, courtesy The Trane Company. See page 63.

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Washington News

LORING F. OVERMAN

WHAT will the changing of the guard mean to the industries concerned with heating, ventilating, air-conditioning, piping and refrigeration?

It seems quite probable that things will go on more or less as they have been during the last two years, with both political parties so preoccupied with their own affairs that they may not turn in any records for unusual accomplishment.

Those affairs, during the first few weeks of the 84th session of Congress, will start with a complete reorganization of both Houses. Committee chairmanships and majorities which bore the G.O.P. label prior to the election are now to be weighted on the Democratic side. The viewpoints of the new majority groups will be making the headlines, but insofar as action is concerned, expect a standoff in many of the projects.

"Another" Look

Statements by the leaders of the new House and Senate majorities give a hint of what the victors have in mind. Said Sam Rayburn, who again will become the House Democratic Leader:

"We'll try to make the farm program more serviceable to farmers. We'll look the tax structure over and iron out any inequities. We'll make a tax bill that will be fair to all people. We shall be for a strong foreign policy, and we'll try to make it a non-partisan policy. We feel we should have a strong national defense, as we had when the Democrats were in, as long as the world is in danger and in the shape it is now."

Washington observers have interpreted Mr. Rayburn's statement to imply more farm subsidies, an increase in the personal income tax exemption, no tax relief for business, more foreign spending, and more spending for defense.

Senate Democratic Leader Lyndon Johnson, who will become majority leader in the Upper House, announced the following program:

(1) A gigantic development program of natural resources, including huge reclamation and conservation projects in the west to provide for expansion of western industry and population.

(2) A material increase in funds for national defense.

(3) A revised and improved farm program to insure the farmer and rancher a greater share of the national income.

(4) Modification and improvement of standards of living giving both the employee and employer the dignity to which they are entitled.

(5) Permit the fullest utilization of all the great facilities of free and private enterprise without permitting payoff to campaign contributors.

Again, observers point out that Messrs. Rayburn and Johnson have said virtually the same things, in somewhat different ways. Since many of these ideas are in direct opposition to the program of Mr. Eisenhower and the Republicans, a head-on clash of interests seems inevitable. Such a situation, observers say, makes it ideal for the newcomers to introduce legislation which they hope will run into a Presidential veto. Thus they would get credit for a good try, with the President taking the blame for putting on the brakes.

About Spending

As for spending, another peculiar situation exists. All of the ideas expressed in the new majority program will cost money, yet a Democratic Congress will not be too enthusiastic about giving a Republican President additional money to spend in any way which might win more friends and influence voters.

Besides that, the Eisenhower program itself calls for the following heavy expenditures:

(1) A $50 billion highway construction program covering a 10-year period.

(2) A school construction program estimated at from $10 to $15 billion in 10 years or less.

(3) Pay raises for federal employees—cost $750 million.

(4) An increase in appropriations for hospital construction, to cost about $300 million.

Government expenditures will probably find some middle ground between the two party ideas of what's right, proper and necessary.

Who Pays The Piper?

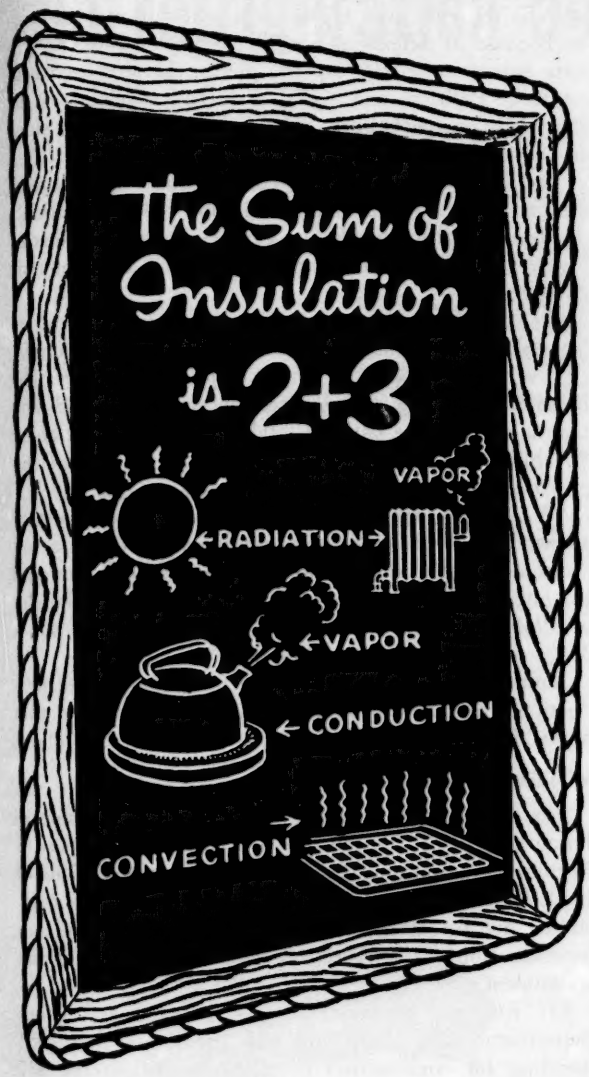
The question of how Government is to finance its spending, promises to be considerably changed with a new crew at the helm of taxing committees. There now seems little likelihood that corporate tax rates will be permitted to drop from 52% to 47% in April, as had been expected.

Instead, further reductions in excise taxes are likely and an effort may be made to strike out of the tax code the limited relief from double taxation of corporate dividends. The new chairman of the House Ways and Means Committee, Jere Cooper of Tennessee, was in favor of increasing the personal income tax exemptions by at least $200 in the last Congress. Assuming that he still feels the same way about it, such a move would remove 13,200,000 taxpayers from the income tax rolls entirely while losing $4.5 billion in annual revenue.

Senator Byrd of Virginia, new chairman of the Senate Finance Committee, is expected to serve as a balance wheel for any extreme or unsound fiscal policies which may originate in the House.

"Politics Paramount"

As matters now stand, it appears that the new Congress may be rich in political activity and poor in constructive accomplishment. By controlling the machinery of government, the Democrats can determine what legislation is to come up for consideration. At this point, one side will fight to prevent any change from the course steered during the last two years. The other side, confident of a Presidential veto, is in a position to favor any vote-



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CONDENSATION MINIMIZED

The aluminum sheets are almost completely impervious to water vapor. Infiltration under flat, stapled flanges is slight. The scientific construction of multiple layers of accordion aluminum, fiber and air spaces minimizes condensation on or within this insulation. Its slight mass produces little heat storage.

To obtain MAXIMUM, **uniform-depth** protection against heat loss and condensation formation, it is necessary to use the new **edge-to-edge** multiple aluminum*, **each** sheet of which stretches from joist to joist, and also all through the flanges for further vapor protection as well as permanent attachment of each sheet.

The U. S. NATIONAL BUREAU OF STANDARDS has published an informative and authoritative report on "Moisture Condensation in Building Walls." This booklet explains the conditions under which condensation will take place in insulated as well as uninsulated walls; what part is played by effective vapor barriers such as metal foils; how to use and interpret thermal-resistance and vapor-resistance fractions. You can obtain it at our expense by sending us the coupon.

*Patent applied for.

winning movement which may become popular. Each decision will be considered in relation to its probable effect on the 1956 Presidential elections, with each side of the Congressional aisle taking the actions which it believes will take the legislative body off of the dead center now threatening to limit its effectiveness.

"Chicken or Egg"

The course which Washington will take between now and 1956 will stem largely from differences of opinion as to which comes first, the business chicken or the wage-salary egg. During the last two years, emphasis has been placed on the premise that if business prospers, the pay check will follow. The reverse reasoning is that only Government can take up the slack and prevent recessions. The latter policy is now in the ascendancy, and such actions as Congress takes in the months ahead will reflect this difference of viewpoint.

Almost immediately, observers believe, Congress will take a quick look at defense spending. The Defense Production Act is to expire on June 30, and in renewing it there may be a tendency to authorize additional expenditures, rather than any curtailment. It is also considered possible that any new defense legislation will be asked to provide standby controls for wages, prices and rents.

Meanwhile there is evidence that at least one effort to trim defense costs is not working out satisfactorily. Reorganization Plan No. 6, effective in July 1953, abolished the Research and Development Board and turned its duties over to two Assistant Secretaries of Defense. Since that time, the question of where research and development stops and applications engineering starts have been major problems.

A new Defense Department Instruction No. 5100.3 has been issued to clarify the relationships of the Assistant Secretary of Defense, Research and Development and the Assistant Secretary of Defense, Applications and Engineering. The Instruction is being interpreted by some as a formal recognition that the functions are so interrelated as to make such a division of responsibility impracticable.

In another Defense order, the President amended his Executive Order No. 10480 dated August 14, 1953, so as to provide authority to additional executive agencies to handle production expansion questions, as delegated by Defense Mobilization Director Arthur S. Flemming. The amended order has the effect of formally authorizing certain functions of the Defense Transportation Administration and possibly the Federal Communications Commission.

Cheerier Note

Although traveling by different routes, two groups of Washington prognosticators have reached similar conclusions—that only the surface has been scratched insofar as this country's living standards are concerned.

Richard L. Bowditch, board chairman of the Chamber of Commerce of the United States predicts that by 1975 our standard of living will be double that of today. He foresees 65,000,000 autos and 20 million trucks on a completely modernized interstate highway system; helicopters for 100-mile hops, jet air liners for four-hour continental flights, and military planes traveling 1400 miles per hour. Homes which are largely prefabricated will be the rule, and big Government will still be with us because of defense needs. Mr. Bowditch looks to private enterprise to step up the picture he sees, and concludes: "Political and social disturbances can toss the optimistic prospects in the ashcan, but if we are left alone to do the job that must be done, we can do it."

The other side of the story comes from a new program entitled "Toward Full Employment and Full Production", drafted by a group headed by Leon H. Keyserling, former chairman of President Truman's Council of Economic Advisors.

This program takes the position that government, to prevent unemployment, must construct and operate facilities to supplement the output of private industry. The program points out that a recession started in 1953, and that as a result the nation's total output is already about $27 billion below what it should be to provide full employment. It continues:

"We must register year by year a minimum annual growth rate of 4.2% in total output to maintain a full economy except insofar as we increase leisure. This would lift our total annual product to $500 billion by the end of 1960, raise the average standard of living by about 35%, and eliminate mass poverty."

Both programs agree as to the need for greater production. How it is to be achieved will be for the nation to decide through this Congress, and the ones that follow.

Washington Miscellany

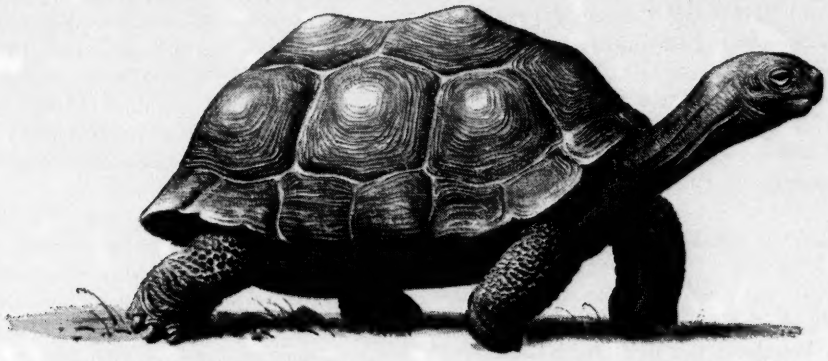
Tax Regulations Delayed. A delay until sometime in January is likely for the new Internal Revenue Service Regulations pertaining to the Internal Revenue Code of 1954. Revenue people had expected to have the new regulations out by December, but drafting the voluminous interpretation of the 1000-page code is proving a difficult assignment.

$37 Billion Estimate Stands. Commerce and Labor Department statisticians are still predicting that 1954 spending for construction of all kinds will exceed $37 billion. October construction totals of $3.5 billion set a new record for the month. The figure was 8% above October of last year, and only 3% below September—a drop considerably less than usual seasonal declines.

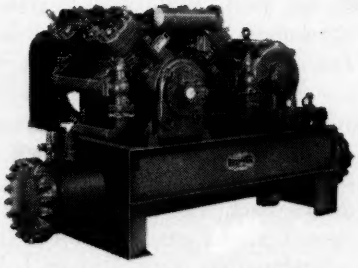
Buck Rogers Rides Again. In reading some Department of Defense items these days, it is hard to realize that the items are "for real" and not out of some Buck Rogers comic strip. Current procurement contracts for the Air Force, for example, provide some $9 million for "guided missiles and components'. There's a $5 million item for pilotless bombers; a $3.6 million item for 200 airborne rocket launchers; $2 million for aeronautical tubes, and a million dollars for "prototypes and mockup of the MD-3". It's all very strange.

West Coast Petroleum Studied. A committee has been appointed to determine the adequacy of petroleum supply on the West Coast during a period of national emergency. The committee, appointed by Defense Mobilization Director Arthur S. Flemming, will cover the entire subject of petroleum transportation to the West Coast, the availability of crude oil and petroleum products for military use in the Pacific, and an analysis of the capacity of petroleum refineries in the area to meet wartime requirements.

in refrigeration and air conditioning...



SLOW SPEED *means* LONG LIFE



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SELF-CONTAINED AIR CONDITIONERS

— completely packaged, easy to install and operate, are supplied in various models in sizes from 2 H.P. to 20 H.P.

Why does the turtle live so long?

From an engineering viewpoint, the answer would probably be "Slow Speed!" Because the speed with which things *move* has a vital effect upon their life and usefulness, the design engineer is *always* concerned with doing *more* work with *less* motion.

BRUNNER slow-speed COMPRESSORS are good examples of this principle. Because they operate at speeds much slower than other compressors of the same capacities, Brunner Compressors deliver full capacity refrigeration and air conditioning with *less* costly motion — *less* wear on working parts, *less* maintenance required — and *lower* operating costs, too.

Brunner Application Engineers are glad to make recommendations. If you're planning to change or add to your line, investigate Brunner—for more Refrigeration and Air Conditioning profits for you. Write - -

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The Brunner Co., Gainesville, Ga.
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BRUNNER SINCE 1906

means dependable refrigeration

BRIEFLY STATED

• The Agricultural and Mechanical College of Texas has announced a Symposium on Instrumentation for the Process Industries to be held in January, 1955. The symposium, tenth in a series inaugurated in 1946, will emphasize new developments from a practical engineering point of view. Talks will be directed toward instrument, design, process, and operating engineers.

• Fred W. Powers, 87, chairman of the board of The Powers Regulator Co., Skokie, Ill., died October 14, 1954. Mr. Powers began his career at LaCrosse, Wis., in his father's plumbing and heating business. When his father founded The Powers Regulator Co. in 1891, Mr. Powers began his sixty years of service to the company. He became president in 1928 and served in that capacity until 1945, when he was elected chairman of the board. Mr. Powers is survived by his widow, Ida T., son David J., a daughter, six grandchildren and five great grandchildren.

• Production of Pennsylvania anthracite in 1953, as reported to the U. S. Bureau of Mines, totaled approximately 31 million net tons, a decline of 24% from 1952. The 1953 output represents the lowest annual figure since 1881. Among the factors principally responsible for the sharp break in production were continued strong competition from petroleum and natural gas in the space-heating field, the virtual disappearance of markets in the Western European countries, and a drop of 28% in exports to Canada. Average winter temperatures were again warmer than normal in the principal anthracite markets and thus contributed to the decline.

• The appointment of Philip C. Kosch as Manager of sales training for the Bryant Heater Division, is announced by Affiliated Gas Equipment, Inc. Mr. Kosch will take over his new duties immediately. Before joining the company, Mr. Kosch was training school manager for the Winkler Division of U. S. Machine Corp.

• Daniel J. Quinn has been named vice president, sales of the plumbing and radiator heating division of American Radiator & Standard Sanitary Corp. Mr. Quinn previously was general sales manager of the division. In his new position he succeeds D. D. Couch, who has been named vice president, marketing and commercial development of the corporation. Mr. Quinn has been associated with the company since 1925. Since 1946 he has held several executive positions in the general sales department of the corporation.

• Mr. Carl W. Millsom has been appointed to the post of vice president, field sales division and advertising of Acme Industries, Inc., of Jackson, Mich. Mr. Millsom has been active in the air conditioning and refrigeration industry since 1935. Previous to coming with Acme, he was associated with Chrysler AirTemp in various executive sales and engineering capacities. He has been with Acme Industries since 1950, first as sales manager of the Flow-Cold Division, and since 1952 as sales manager of all field sales.

• Prat-Daniel Corp. and Day and Night Division of Affiliated Gas Equipment, Inc., have announced the acquisition by Prat-Daniel of the patents, sales and manufacturing rights of Overhead Panelray, a gas-fired infrared industrial and commercial heating device, developed and sold over the past six years by the Day and Night Division. The Day and Night Division will continue the manufacture of the product for the balance of this heating season. The heating equipment will be sold through Prat-Daniel's nationwide sales organization plus already established distributor outlets.

• Marshall B. Taft has been named general manager of the valve division of Minneapolis-Honeywell Regulator Company. He succeeds Stephen A. Keller, who has been named general manager of the new Heiland division of the company in Denver. Mr. Taft was formerly assistant to the president of the firm's industrial division in Philadelphia.

• General Controls Co. has appointed John A. Wolff to the post of heating controls division sales manager at the company's headquarters in Glendale, Calif. Mr. Wolff comes to General Controls from Milwaukee Specialties Co. where he has been national sales manager.

• Two York Corp. executives, Ray K. Serfass, general sales manager, and J. M. L. Joslin, manager, industrial relations, have been named vice presidents of the York, Pa. firm. Mr. Serfass graduated from the corporation's student training program in 1932. Before joining the firm in 1948, Mr. Joslin had a varied career in the field of industrial relations including connections with Sharp & Dohme, Inc. and Firestone Tire & Rubber Co.

• The appointment of Richard B. Sweet as sales manager of the Wholesale Division, John J. Nesbitt, Inc., is announced by the company. In this capacity, Mr. Sweet will direct the sales activities of the company's baseboard radiation, convectors and gas-fired unit heaters from its Philadelphia headquarters office. Michael J. Murray, who until recently was manager of the Wholesale Division, will now take on the sales management of another of the company's heating and ventilating products.

• A. B. Drastrup has been elected president of A. M. Byers Co. He succeeds L. F. Rains, who is retiring after 23 years as president and director of the company. Mr. Drastrup has been executive vice president of the firm since February, 1954. He joined the company in 1931 as plant auditor.

• The Ric-Wil Company of Barberton, Ohio, announces the appointment of William F. Wood as general sales manager. Mr. Wood was formerly district manager in charge of the Washington, D. C. office and has been with the company for the past 16 years.

• A. G. Masiello, previously of Remington Corp., has been appointed to the newly created post of assistant sales manager for Typhoon Air Conditioning Co. Inc. Prior to his association with Remington, he spent twelve years with Carrier Corp. in a number of capacities.

Buy One—Get Two!

...fort
...factory
...mperatures
without other investment!

IT IS generally agreed that classroom temperatures should be maintained at about 55° overnight and during periods of shut-down in cold weather. This permits quick recovery to comfort conditions and more stable control during the first hours of the next school day.

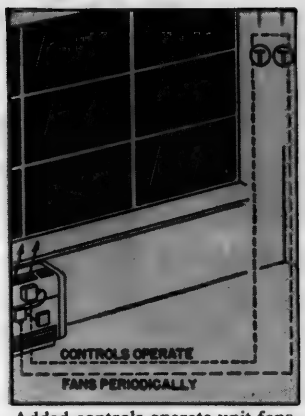
Cutting off the heat altogether, and letting the classroom temperature drop to 40° or 45°, makes the recovery difficult—particularly in restoring heat to the floor slab, walls, desks, etc.—and leads to morning room-temperature fluctuations, possible overheating, and abnormal bodily heat losses to surrounding objects.

In designing unit ventilator systems to maintain an optimum overnight temperature, either of two methods have been employed: a) operating the units as heaters (recirculation only) under thermostat control; or b) installing supplementary gravity heating with additional piping and controls.

Extensive field tests have proved that when Wind-o-line Radiation is integrated with Nesbitt Syncretizers, the combined gravity heating capacity is ample to maintain overnight temperatures of 55° in zero weather. Hence this one system that sets the standard for daytime performance eliminates the cost of separate provision in each room for maintaining overnight temperatures, and simplifies—for greater economy—the control of overnight temperatures from one location in the building.

Get more for your school building dollar... go NESBITT.

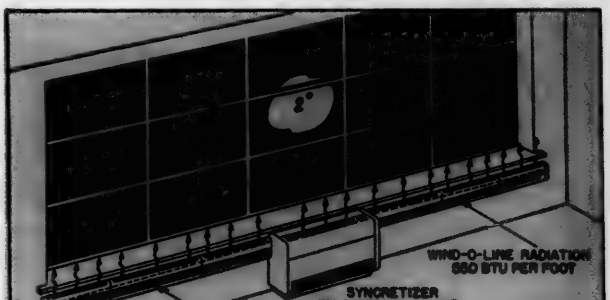
Send for Engineering Report SL-6.



Added controls operate unit fans periodically through the night.

Convector provides supplementary heat, but is not used during day.

ABOVE: THE OLD WAYS—BELOW: THE NESBITT WAY



Gravity heat of Syncretizer and Wind-o-line maintains satisfactory overnight temperatures—without additional equipment or controls.

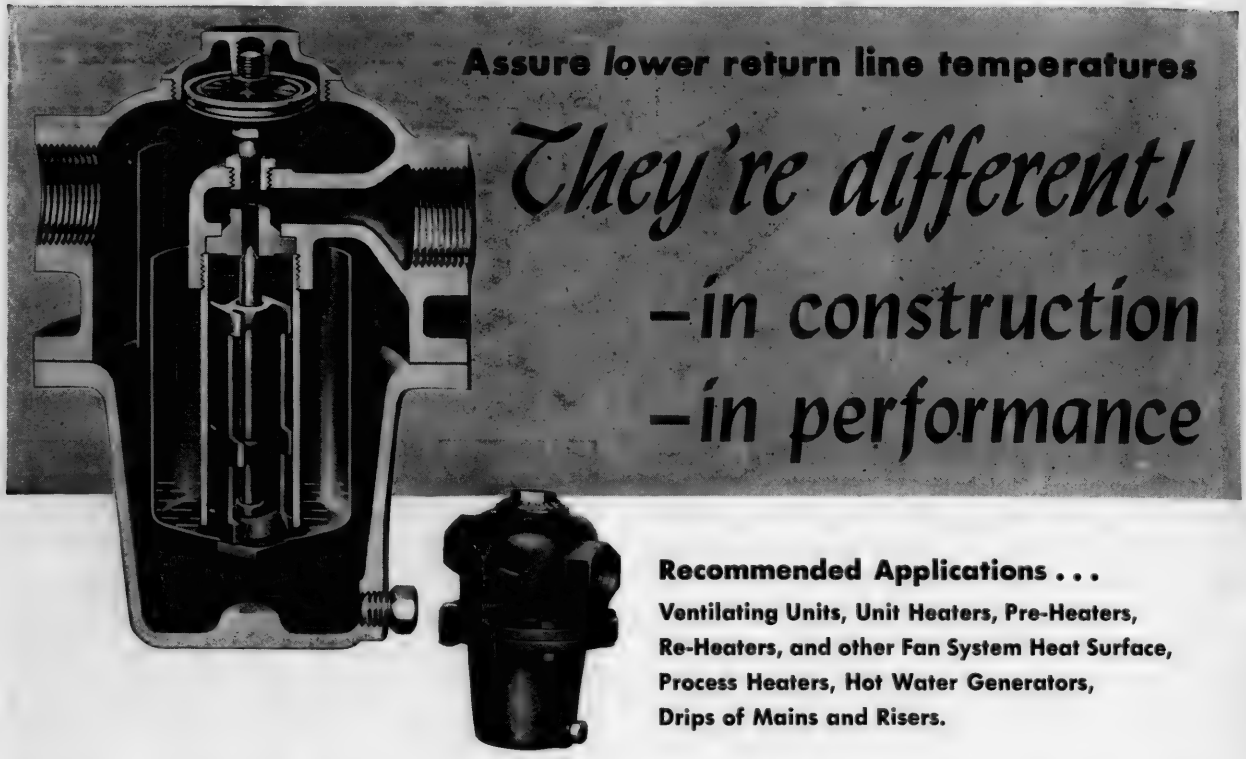
NESBITT *Syncretizer* WITH WIND·O·LINE

MADE AND SOLD BY JOHN J. NESBITT, INC., PHILADELPHIA 36, PA., SOLD ALSO BY AMERICAN BLOWER CORPORATION.

illinois

FLOAT AND THERMOSTATIC TRAPS

SERIES G • FOR LOW PRESSURE STEAM SERVICE



Recommended Applications . . .

Ventilating Units, Unit Heaters, Pre-Heaters, Re-Heaters, and other Fan System Heat Surface, Process Heaters, Hot Water Generators, Drips of Mains and Risers.

Illinois Float and Thermostatic traps operate under vacuum with the same high efficiency as under pressure. No more water-logging in mains...no more air pockets...put an end to "morning overload" troubles. The condensate control valve provides complete and instantaneous drainage of condensate while a separate thermostatically controlled valve in cover vents air in large volume, yet prevents loss of valuable steam.

The condensate valve is actuated by impact when the float drops—a snap action that is independent of the rate of flow of the condensate. Valve is not directly attached to the float and is either tightly closed or wide open. This instantaneous operation makes wire drawing impossible.

Illinois traps, because of their unique valve action, function perfectly at all load conditions, with lower return line temperatures than ordinary type traps. Lower return line temperatures assure higher vacuum pump efficiency. Straight through connections save head room, fittings, labor. Trap is easily opened for inspection. It is not damaged by freezing. Sizes from ¾ inch to 2 inches.

Write for Bulletin

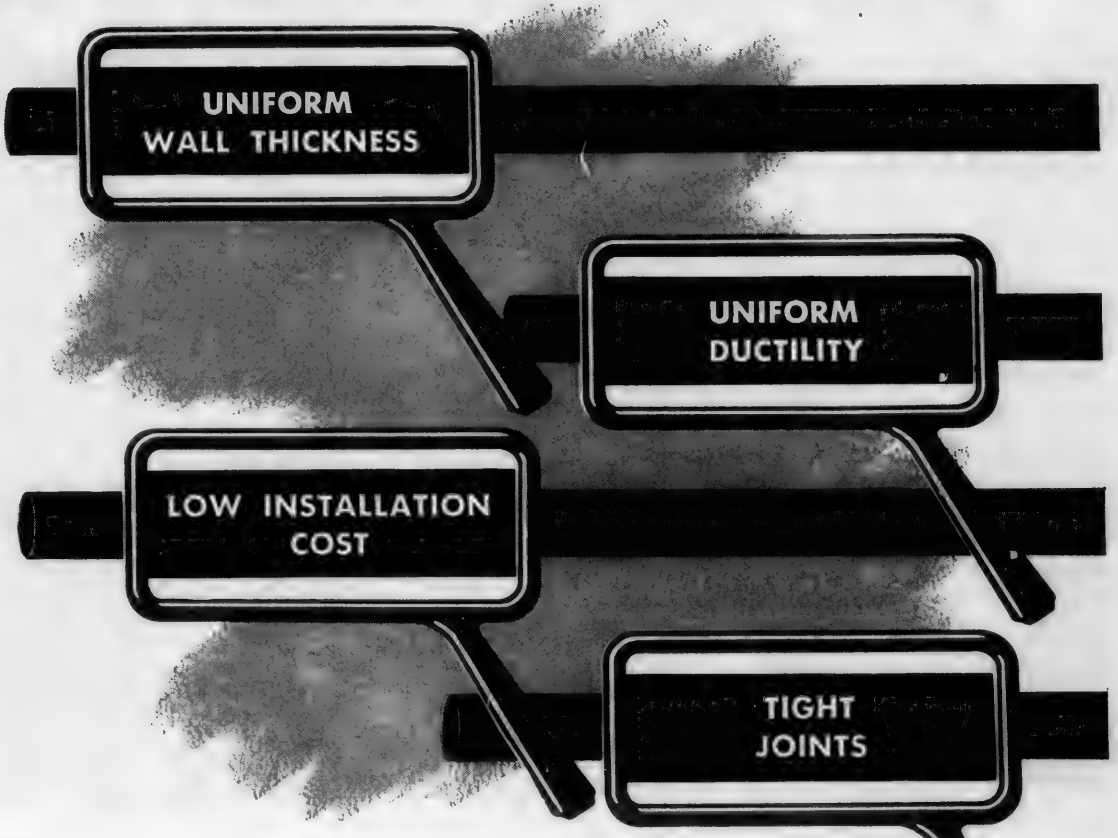
ILLINOIS ENGINEERING COMPANY

illinois ENGINEERING

2045 SOUTH RACINE AVENUE • CHICAGO 8, ILLINOIS

DIVISION OF AMERICAN AIR FILTER COMPANY, INC.

What to Look for in a Boiler Tube



LOOK FOR THIS

— wherever fine boilers are operating efficiently over extended periods. To meet the specifications of time, say B&W before you say WELDED BOILER TUBES — for service-proved dependability.

A OHS 15
B & W TUBES ERW

B&W SEAMLESS and WELDED TUBES

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION
Beaver Falls, Pa.: Seamless Tubing, Welded Stainless Steel Tubing
Alliance, Ohio: Welded Carbon Steel Tubing

TA-4080(CWP)

Give your clients better indoor weather

Why Honeywell Customized Temperature Control is a "must" in modern buildings

In every line of business how well your clients do eventually gets down to one thing—how well do they please people?

This includes customers and employees.

And it's valid whether they deal in products or services.

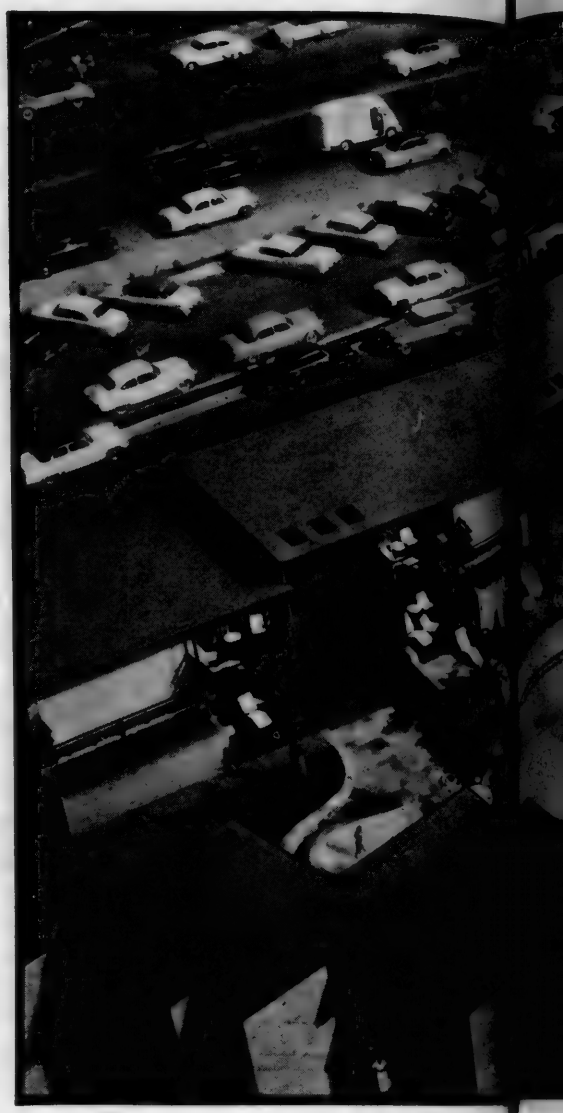
In the hotel business comfort is sold—and to a different set of customers every night.

This is the big reason why the hotel you see here (the Jack Tar Hotel in Galveston) features Honeywell Customized Temperature Control. Each unit has its own set of Honeywell *electronic* controls to give customers better Indoor Weather. Comfort is provided by chilled water for cooling, hot water for heating—and dehumidification during the muggy summer months.

The *techniques* used, applied to your particular problems, can help you give your clients the Indoor Weather they've always wanted—customized to their requirements.

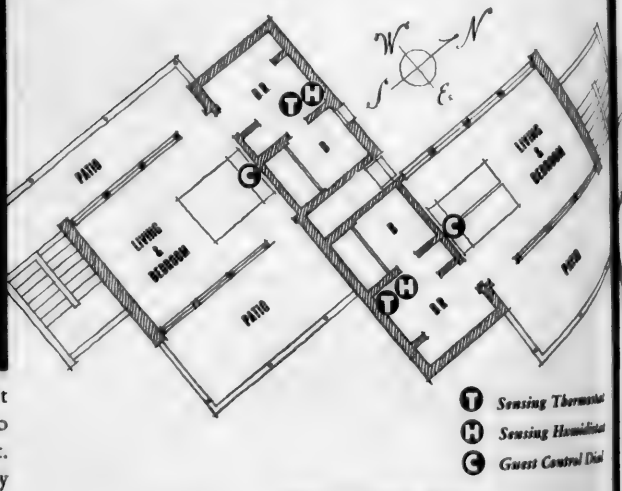
The key word here is "customized." It means that whatever your clients' control requirements, a Honeywell Customized Temperature Control installation *designed to fit the needs of the building and its occupants* is your answer. This applies not only to heating and cooling, ventilating and humidity control, but to industrial control as well.

Only Honeywell can provide true "customized" control. Because only Honeywell manufactures all three types of controls—pneumatic, electric and electronic.

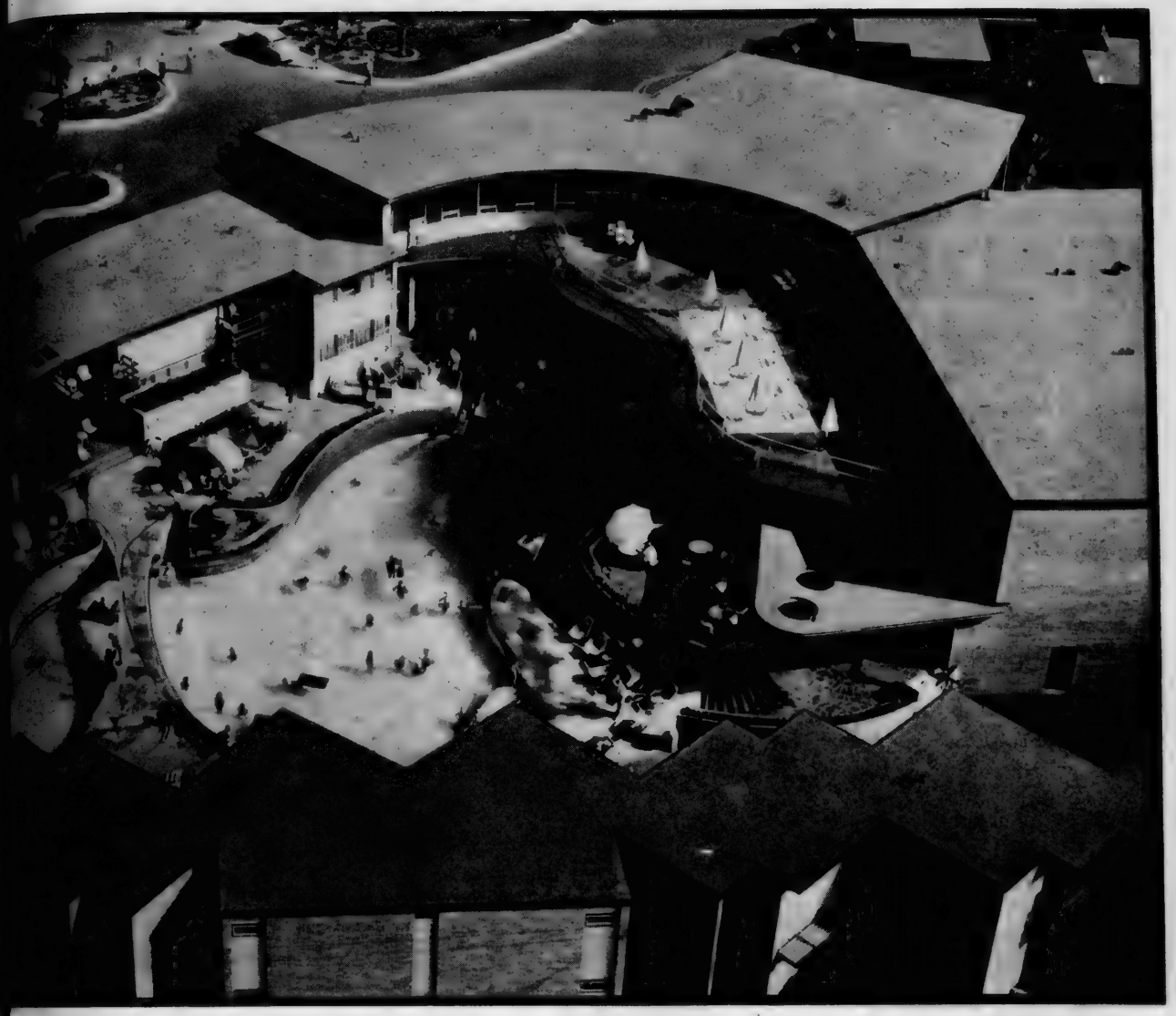


Electronic controls are important to comfort in the Jack Tar Hotel in Galveston, Texas. Humid air from the Gulf of Mexico across the highway—and heat from the Texas sun—demand the rapid response provided only by electronic controls. Architect: Thomas M. Price; Consulting Engineers: Olin Rivoire, Joseph A. Poole; Mechanical Contractor: Way Engineering Co.

Individual comfort is insured by an *electronic* control panel built into the bed headboard of each unit. Customers simply turn a knob for more or less heating or cooling—and the system does the rest. With Honeywell Customized Temperature Control on the job, they get the *exact* degree of comfort they want.



TYPICAL 2nd FLOOR UNITS



For comfortable, even temperature in new or existing buildings—of any size—specify Honeywell Customized Temperature Control

Whether it's a hotel, hospital, factory—any building of any size—new or existing, Honeywell Customized Temperature Control can help meet your clients' heating, ventilating, air conditioning and industrial control problems. You can give your clients more comfort and efficiency, and they'll save fuel, too.

For full facts on Honeywell Customized Temperature Control, call your local Honeywell office. Or mail the coupon today.

Pioneers in Electronic Control

MINNEAPOLIS
Honeywell

112 OFFICES ACROSS THE NATION

First in Controls

Ed. C. Leach, president and managing director, Jack Tar Hotels, says:

"We used a Honeywell Electronic control system because it allows for personalized temperature selection. And because, like everything else about the Jack Tar Hotel, it's modern in every detail."

MINNEAPOLIS-HONEYWELL REGULATOR CO.
Dept. HV-12-225, Minneapolis 8, Minnesota
Gentlemen:

I'm interested in learning more about Honeywell Customized Temperature Control.

*Name*_____

*Firm Name*_____

*Address*_____

*City*_____ *Zone*____ *State*_____

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OF SUCCESSFUL MANUFACTURING EXPERIENCE

YOU'LL SELL MORE PROFITABLE JOBS

with the complete line of

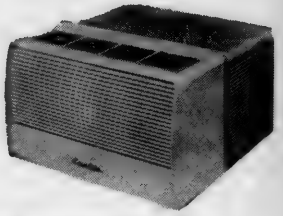
Curtis

AIR CONDITIONING AND REFRIGERATION EQUIPMENT

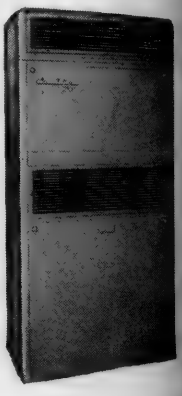
Every product in the Curtis line is built with quality material and workmanship.

Curtis equipment is known around the world for its dependability and efficiency.

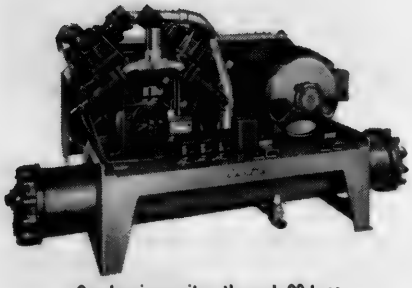
With the complete Curtis line, you can handle any installation for **Home, Office, Store,** or **Factory.**



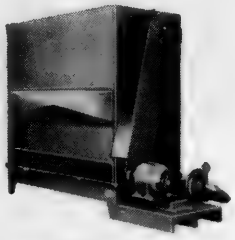
Room Air Conditioner—an attractive, efficient unit with a BIG market potential



Packaged Units—2, 3, 5, 7½ and 10 tons Choice of open or semi-hermetic compressors... and 15 ton packaged Central type units



Condensing units—through 80 tons



Evaporative Condensers, Cooling Towers and Air Handling units to match

Residential cooling and heating units

You may qualify for a direct factory franchise. Write us, using your company letterhead.

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National advertising in *Saturday Evening Post, Time, Newsweek* and *House and Home*, plus many other publications helps sell Curtis to your customers and prospects. Attractive new sales literature is available to help you sell in your local area.

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OF CURTIS MANUFACTURING CO.

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Only the Rich can afford poor heating!

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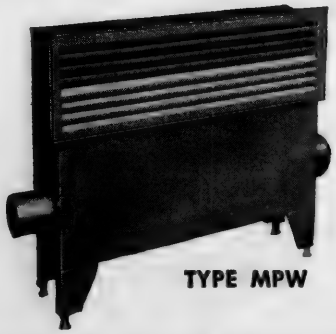
Doing One Thing Well

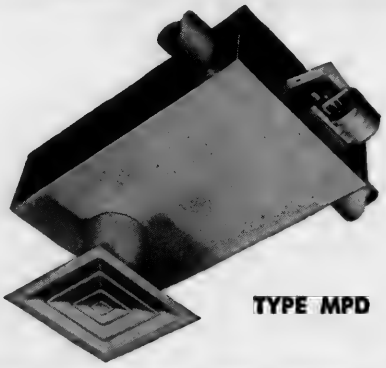
Air Conditioning Systems are on a diet...

thanks to

Tuttle & Bailey High Pressure Air Distribution Units



TYPE MPW



TYPE MPD

T&B HIGH PRESSURE INSTALLATIONS INCLUDE: Bethlehem Steel Co., Bethlehem, Pa. • Dallas County Building, Dallas, Texas Dearborn Bank, Dearborn, Mich. • Decatur-Macon County Hospital, Decatur, Ill. • General Telephone Exchange, Chicago, Ill.

IF YOU can reduce the space you need for an air conditioning system, you can obviously effect substantial savings in the over-all cost of a building. With a high pressure air conditioning system, you can do just that.

Small, low-cost conduit-type risers and branch feeders add more usable or rentable floor space, reduce floor-to-floor dimensions, and require fewer supplementary equipment rooms.

High pressure is the ideal type of air conditioning system for new multi-story office buildings, schools, hospitals, hotels, and institutions. It is also *particularly* well suited to installation in existing buildings where high pressure eliminates the need for major remodeling. In fact, in many older buildings, such a system is the *only* answer to air conditioning.

A pioneer in the development of the high pressure theory, Tuttle & Bailey manufactures a complete line of equipment to meet the varied requirements of a wide range of buildings and types of construction. Tuttle & Bailey Units include single and double duct wall and ceiling types for individual unit or zone control, and are capable of handling branch duct velocities up to 4000 feet per minute.

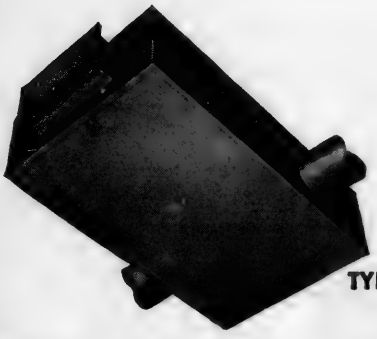
The units shown below typify the Tuttle & Bailey line which is backed by extensive on-the-job experience, and one of the best-equipped Research Laboratories in the industry where T&B engineers can duplicate field conditions and pretest equipment and thus offer maximum assistance to architects and engineers.

To learn how you can take advantage of Tuttle & Bailey's high pressure know-how, get in touch with your nearest T&B Representative or the Home Office.

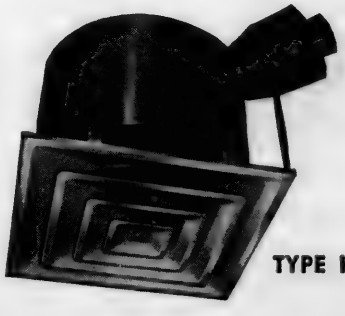
For information on the complete line of Tuttle & Bailey High Pressure Air Distribution Units, write for Bulletin 109.

TUTTLE & BAILEY INC

NEW BRITAIN, CONN.



TYPE MP



TYPE HPD

IBM World Headquarters, New York, N.Y. • Latter Day Saints Society Building, Salt Lake City, Utah • Lever House, New York, N.Y. People's National Bank, Little Rock, Ark. • Seamen's Bank for Savings, New York, N.Y. • Sinclair Oil Building, Tulsa, Okla.

The most convincing stamp of user satisfaction

9 repeat orders for Sarco Heating Specialities

Engine factory of Caterpillar Tractor Co., Peoria, Ill. *Architects & Engineers:* Giffels & Vallet Inc., L. Rossetti Assoc., Detroit. *Heating Contractor:* The Stanley-Carter Co., Detroit. Sarco heating specialties also are providing trouble-free service in Caterpillar's Joliet and Decatur, Ill. and York, Pa. plants.

...won by past performance at Caterpillar Tractor Co.!

SARCO heating specialties were first installed in a Caterpillar plant back in 1947.

Since that first order, Sarco heating specialties have been ordered an *additional nine times* for four Caterpillar plants — each repeat order is indicative of the confidence Caterpillar has in Sarco performance.

Today, more than 1800 Sarco steam traps in addition to other heating specialties give trouble-free service at four Caterpillar Tractor Co. plants.

Architects, engineers and heating contractors appreciate this kind of dependability. It assures them complete user satisfaction, protects reputations, eliminates trouble-some call-backs. Why not specify Sarco on *your* next job?

For full information on all Sarco products, write Sarco Co., Inc., Empire State Bldg., New York 1.

America's Industrial Leaders Repeatedly Order Sarco Heating Specialties

Aluminum Co. of America
Bethlehem Steel Co.
Caterpillar Tractor Co.
Ford Motor Company
Lederle Laboratories (Div. of American Cyanamid Co.)
United Aircraft Corporation
U. S. Steel Company
Western Electric Company

2102-B

SARCO *saves steam*

STEAM TRAPS • TEMPERATURE CONTROLLERS • HEATING SPECIALTIES

Radiator Valves • Traps | Strainers | Float-Thermostatic Traps | Camlift Bucket Steam Traps | Thermostatic Traps | Water Blenders | Air Eliminators | Dial Thermometers | Self-Operated Temp. Reg.

AT THE VERY HEART OF FINE REPUTATIONS..

AN EMERSON ELECTRIC MOTOR

The valuable extra you get with your Emerson-Electric motor

You probably know that the Emerson-Electric motor has helped to build more than one product reputation by its outstanding performance.

But are you aware that you can take advantage of the specialized experience and technical skill of Emerson-Electric Engineers and Designers on anything related to electric motors?

Often, a simple change in design or production technique can save you many dollars, deliver better performance for you. Remember, Emerson-Electric has specialists ready to help solve your most complex motor problems.

THE EMERSON ELECTRIC MANUFACTURING CO.
St. Louis 21, Mo.

Write for information on this consulting service, or bulletins on Emerson-Electric's complete line of NEMA standard motors from 1/20 to 5 h. p. (Check Bulletin desired.)

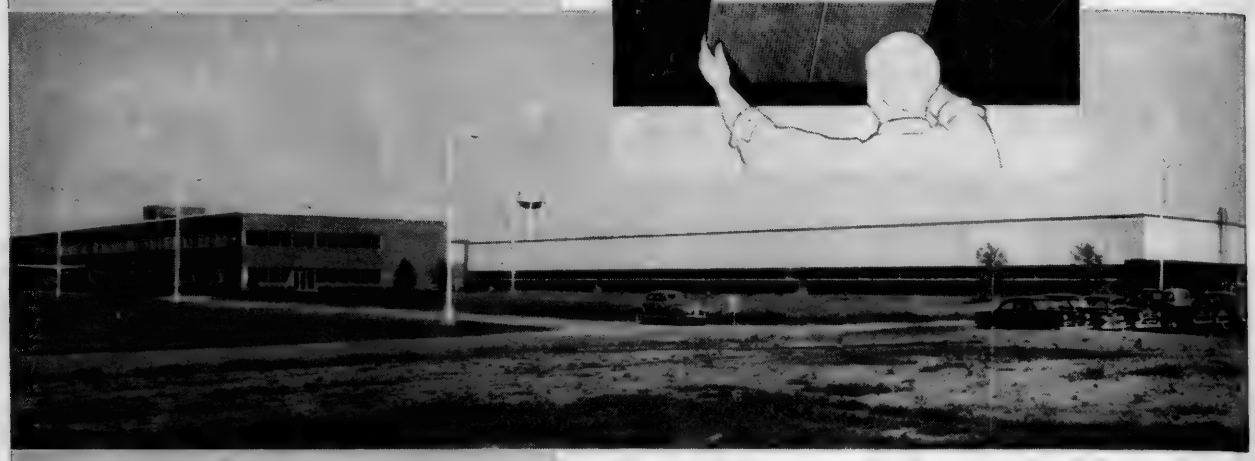
- ☐ M457-A Capacitor-Start
- ☐ M457-B Split-Phase
- ☐ M457-C Integral
- ☐ M457-D Fan Duty
- ☐ M457-E Oil-Burner
- ☐ M457-F Jet Pump
- ☐ M457-G Blower

EMERSON ELECTRIC
MOTORS • FANS APPLIANCES

IDEAL "INDOOR WEATHER" WITH... multi-vent

LOW VELOCITY AIR DIFFUSERS

FOR WESTINGHOUSE



Westinghouse Meter Division Plant, Raleigh, N. C. Robert and Company Associates, Atlanta, architects and engineers.

Partial list of prominent companies which have recently installed Multi-Vent in offices, plants and laboratories.

Boeing Airplane Co.
Cincinnati Gas & Power
Dow Chemical Co.
I. E. DuPont DeNemours & Co.
Ford Motor Co.
General Telephone Co.
H. J. Heinz Co.
International Harvester
Eli Lilly & Co.
Mead Johnson & Co.
Ohio Oil Co.
Pittsburgh Plate Glass
Rand McNally & Co.
Sawyer Biscuit Co.
G. D. Searle Co.
Sharp and Dohme
Southern California Gas
Standard Oil of Indiana
U. S. Steel Corp.
Yale & Towne

FOR GENERAL OFFICES—LABORATORIES ENGINEERING DEPARTMENTS—TEST ROOMS

As in the Westinghouse plant, illustrated above, and in other industrial plants, Multi-Vent is specified where true air conditioned comfort or accurate control of air movement, temperature and humidity is demanded.

Because Multi-Vent is designed and engineered for easy installation and to handle high loads and high ventilating requirements, with a uniform low rate of room-air motion, it meets the most exacting demands of industrial processing and scientific research.

Flush or completely concealed in the ceiling, Multi-Vent distributes air at low-velocities by gentle pressure displacement, thus providing a degree of air conditioned comfort unmatched by any other diffuser. Write for detailed literature.

THE PYLE-NATIONAL COMPANY
1374 North Kostner Avenue, Chicago 51, Illinois

MULTI-VENT DIVISION
Sales and Engineering Representatives in Principal Cities of United States and Canada

—the finest reference of its kind ever offered!

A NEW TECHNICAL REFERENCE

Your "how-to" Catalog on Roof Drains

A complete, informative guide for specification and installation: roof drain and outlet sizing data, installation drawings of drains in standard types of roof construction, complete illustrated index, large easy-to-read product drawings, descriptions of new products and many innovations never before seen in product cataloging. Write for your copy — today !

A REFERENCE, A MANUAL, *and* A CATALOG

ZURN ROOF DRAIN MANUAL 54-1

Latest, Most Factual Information Obtainable on Roof Drains

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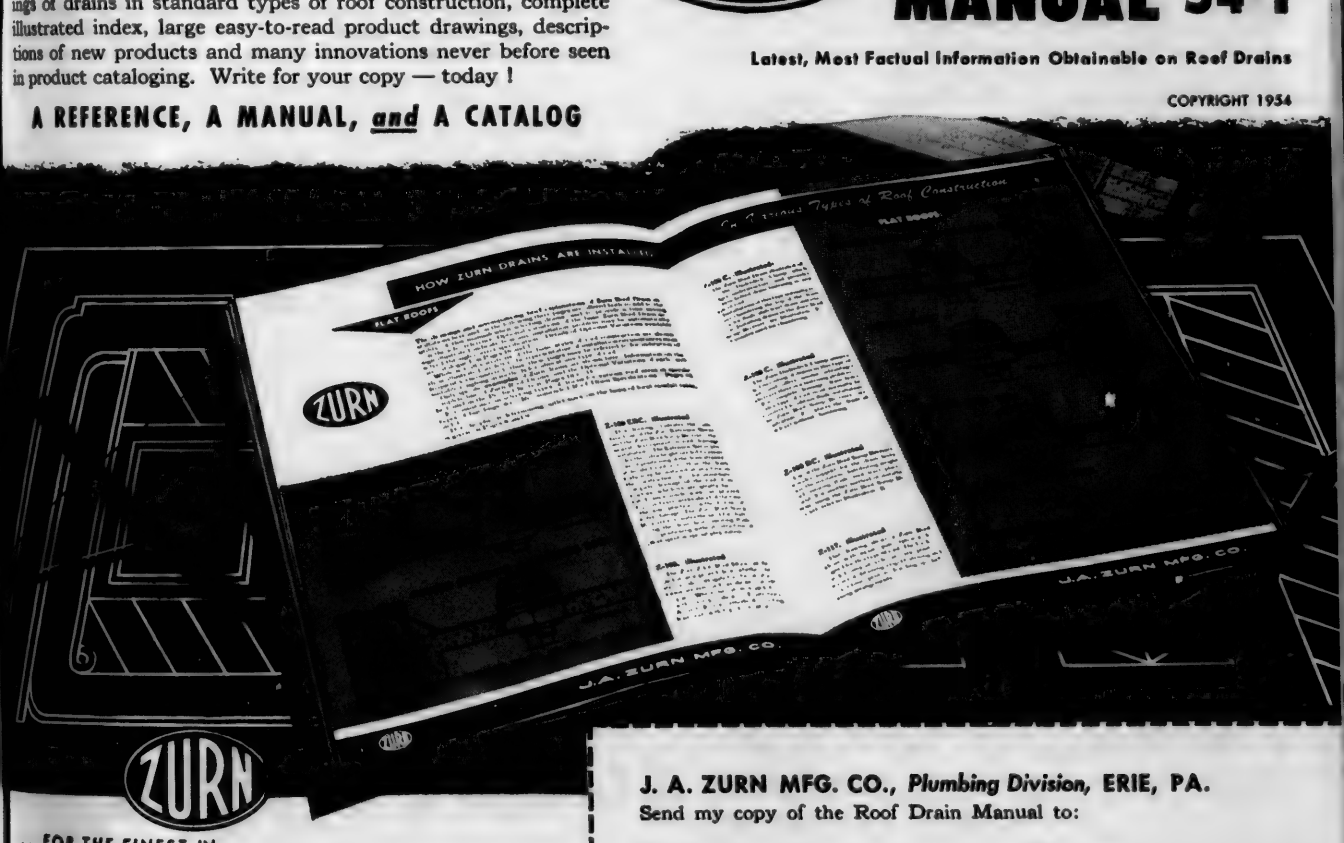

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J.A. ZURN MFG. CO.
ERIE, PA., U.S.A.

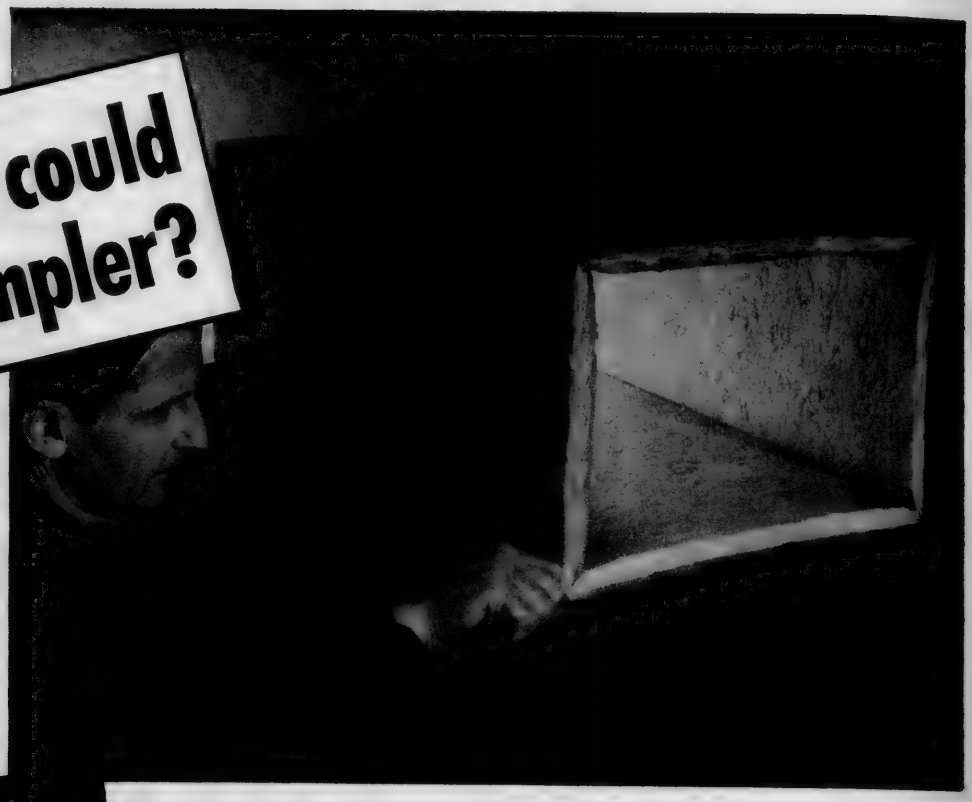
Sales Offices in Principal Cities of the World

AFFILIATE: AMERICAN FLEXIBLE COUPLING COMPANY
CANADA: CANADIAN ZURN ENGINEERING LTD., MONTREAL, P. Q.

J. A. ZURN MFG. CO., *Plumbing Division*, ERIE, PA.
Send my copy of the Roof Drain Manual to:

Name ..... Title .....
Company .....
Address .....
City ..... Zone ..... State .....
Dept. HV-934

What could be simpler?



Install Microlite Coated Duct Liner

without precision cutting and... without fitting of separate pieces

If there's any simpler way of lining ducts we've never heard of it. Just cut the required length from a roll of Microlite glass fiber duct liner and apply it to the sheet metal by adhesive. Then form the insulated duct section in the brake. That's all. No precise cutting. No fitting of separate pieces. No special procedures of any sort. And when you're all through you've got a most efficiently insulated duct.

SOUND ABSORPTION VALUE: ½ inch liner has a noise reduction coefficient of .60; 1 inch of .80.

THERMAL QUALITIES: "k" value of .20 at 50°, .21 at 75°, .23 at 100°, .27 at 150°, .31 at 200°.

AIR EROSION RESISTANCE: Coated liner for all velocities up to the highest normally required. If desired, uncoated liner may be used for velocities under 3000 feet per minute.

FEATHERLIGHT: 1 inch liner with coating on one side weighs less than 2¼ ounces per square foot.

HANDLE-ABILITY: Extremely soft, resilient and pleasant to handle. Doesn't cause itching. Men like to work with it.

For a technical bulletin and sample, and name of your nearest distributor, write to Glass Fibers Inc., 1810 Madison Avenue, Toledo 2, Ohio.

VITRON Glass Textile Yarns • Rovings • Micro-Fibers

DURAMAT Vapor Barriers • **BLUE FLAG** Pipe Wrap

MICROLITE Thermal and Acoustical Insulation

COUSTIC-AIRE and **THERMO-JET** Aircraft Insulations

GLASS FIBERS *INC.*

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A COMPLETE LINE OF WALL and BASEBOARD RADIATION for STEAM and HOT WATER SYSTEMS

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Makers of Valves for Hot Water Heating Systems, Vacuum Pumps

OAKWOOD HOSPITAL — Architects: Stanton & Hillier. Consulting Engineer: George Wagschal Associates. Building Contractor: W. E. Wood Company. Heating Contractor: Page Plumbing and Heating Company.

American Blower primary and secondary fans supply heated air to rooms, offices, dining room, kitchen and corridors. Surgery, with its precise requirements for specially conditioned air, also depends on American Blower equipment. The kitchen unit relies on an American Blower sprayed coil dehumidifier.

"Ventilation was a major factor in planning for the health and comfort of our patients"

—FRED BECHTOL, BUILDING SUPERINTENDENT, OAKWOOD HOSPITAL

Proper balance of air between supply and exhaust is air handling equipment's biggest job. Oakland Hospital used a total of 10 American Blower HS fans (two are shown here) to handle air exhaust.

Air handling equipment in a modern hospital must be dependable and quiet in operation. The health and comfort of the patients demand it. At Oakwood Hospital, $5 million medical center in Dearborn, Michigan, American Blower air handling equipment was specified.

Fred Bechtol, Building Superintendent, appreciates the way American Blower equipment is built to run continuously at rated capacities, with no breakdowns and minimum maintenance expense. American Blower engineers welcome the opportunity to cooperate with you. If you have an air handling problem, give your nearest American Blower or Canadian Sirocco Office a call.

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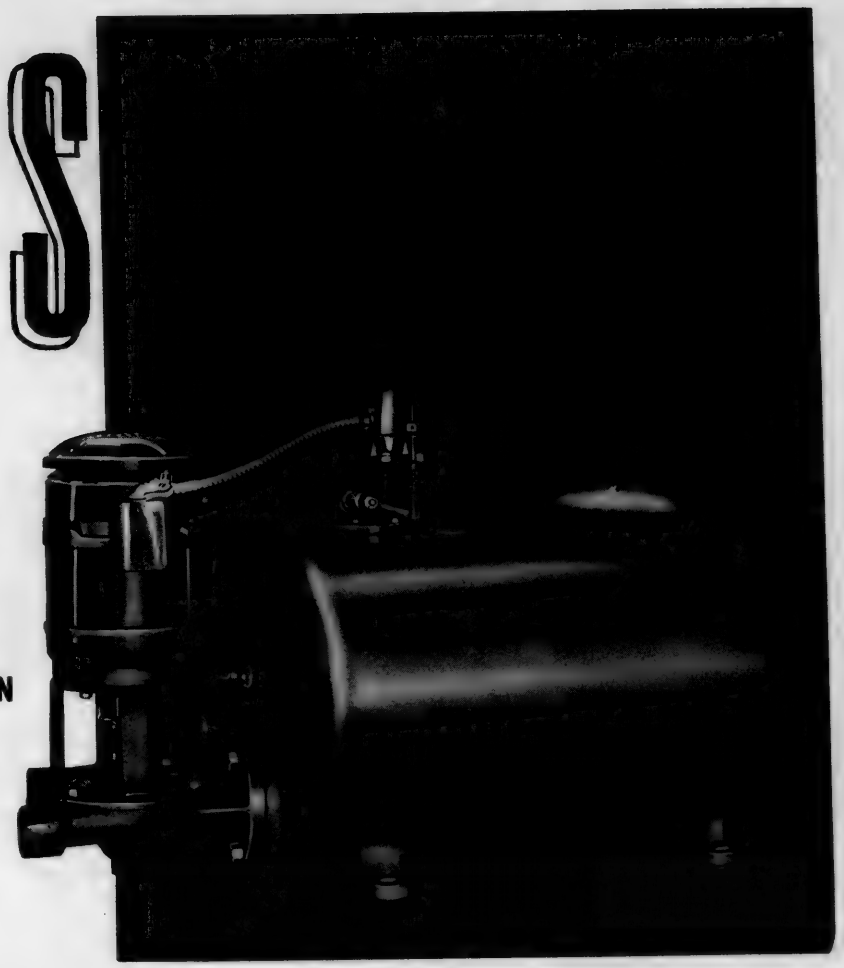
TYPE "VC"

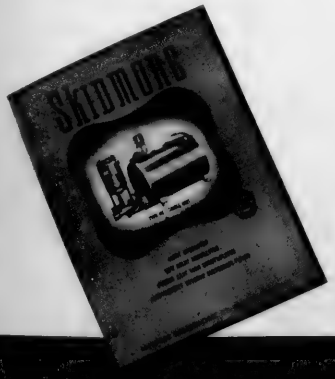
QUIET OPERATION

LOW INLET CONNECTION

EASILY ACCESSIBLE



YOUR COPY — Send today for bulletin 10-B. Complete information and engineering data are enclosed.



Designed by men who really know pumps . . . men who have had years of experience in the field—the "VC" Condensation Pump is built for rugged and dependable service. Like all SKIDMORE PUMPS, the "VC" Unit is correct in every detail . . . yet simple in construction —assuring ease of accessibility and a minimum of wear. Specify a SKIDMORE PUMP on that next job . . . there's one for every installation.

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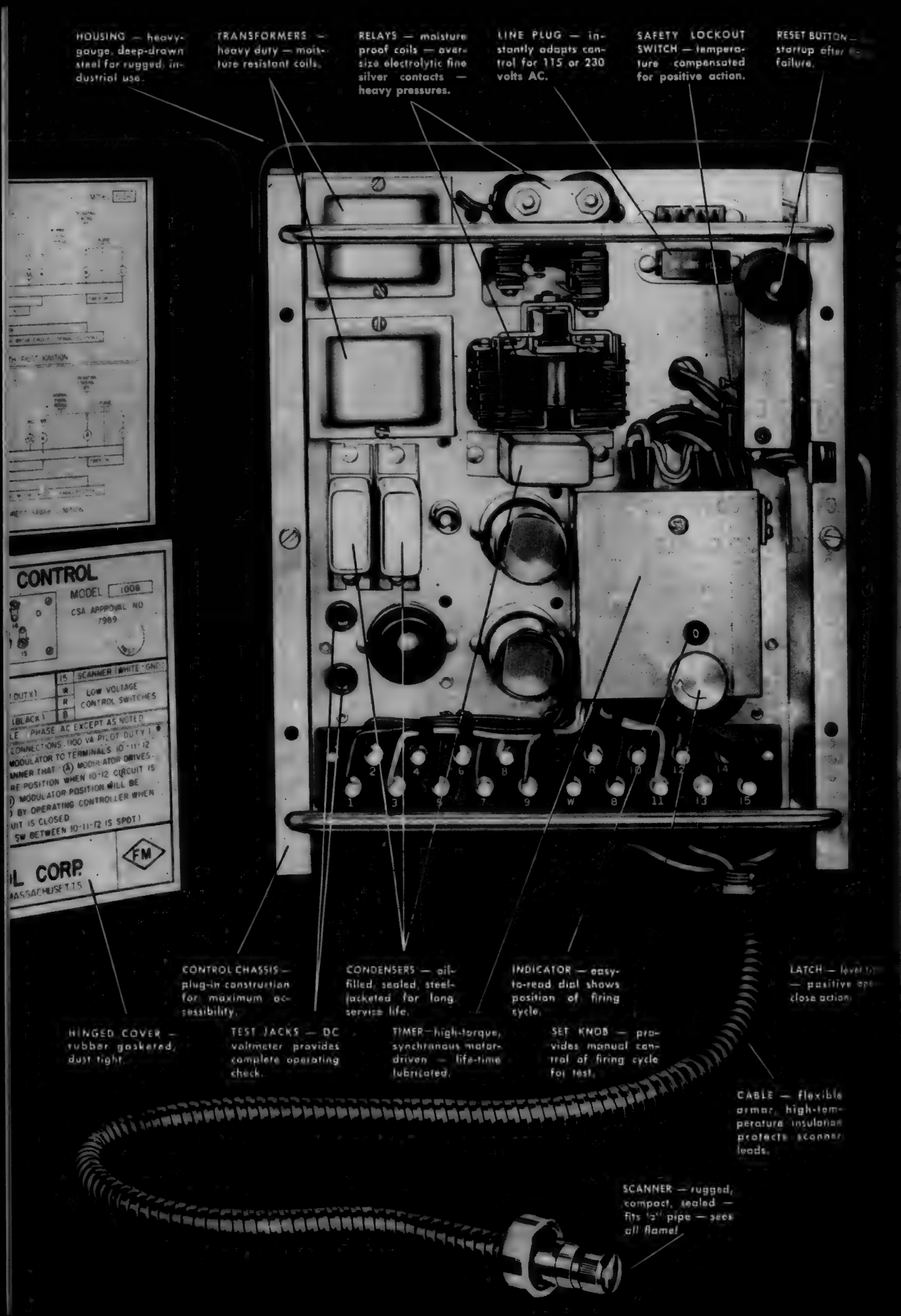
HOUSING — heavy-gauge, deep-drawn steel for rugged, industrial use.
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RELAYS — moisture proof coils — oversize electrolytic fine silver contacts — heavy pressures.
LINE PLUG — instantly adapts control for 115 or 230 volts AC.
SAFETY LOCKOUT SWITCH — temperature compensated for positive action.
RESET BUTTON — startup after failure.
CONTROL
MODEL 1008
CSA APPROVAL NO 7989
SCANNER (WHITE-GND)
LOW VOLTAGE CONTROL SWITCHES
CONTROL CHASSIS — plug-in construction for maximum accessibility.
CONDENSERS — oil-filled, sealed, steel-jacketed for long service life.
INDICATOR — easy-to-read dial shows position of firing cycle.
LATCH — lever
— positive
close action
HINGED COVER — rubber gasketed, dust tight.
TEST JACKS — DC voltmeter provides complete operating check.
TIMER — high-torque, synchronous motor-driven — life-time lubricated.
SET KNOB — provides manual control of firing cycle for test.
CABLE — flexible armor, high-temperature insulation protects scanner leads.
SCANNER — rugged, compact, sealed — fits ½" pipe — sees all flame!

flame-sensitive CELL — d, lifetime construction — r wears out. Sees through , soot, smoke.

Amazingly compact SCANNER cuts installation costs — screws on end of ½" pipe. Single scanner detects both pilot and main flames.

Readily accessible TERMINAL PANEL — clearly marked terminals for easy wiring — ample trough space. Allows for extra operating controls and alarms.

PLUG-IN CHASSIS removes in seconds without disturbing wiring — simplifies installation, maintenance, replacement. Husky guide pins, self-aligning sockets insure reliable contact.

Why fireye is the standard...

for flame failure protection and automatic programming of industrial oil burners.

9 out of 10 new package burners are Fireye FP-2 equipped. Ruggedness and performance features brought about this overwhelming acceptance . . . and they'll make a hit with you too!

Proved in 50,000 installations, the FP-2 Control provides safe programming for any burner application — is easy to install and service — gives long-time dependability with minimum maintenance. Components are of superior industrial quality — withstand moisture, vibration, high temperature — give continuous peak performance. *Every unit is cycle-tested equivalent to one month's operation before leaving the factory.*

A single, compact scanner provides positive flame failure protection through electronic supervision of both pilot and main flames. Never wears out. Can be used with combination oil/gas burners too, because it *sees all flame!*

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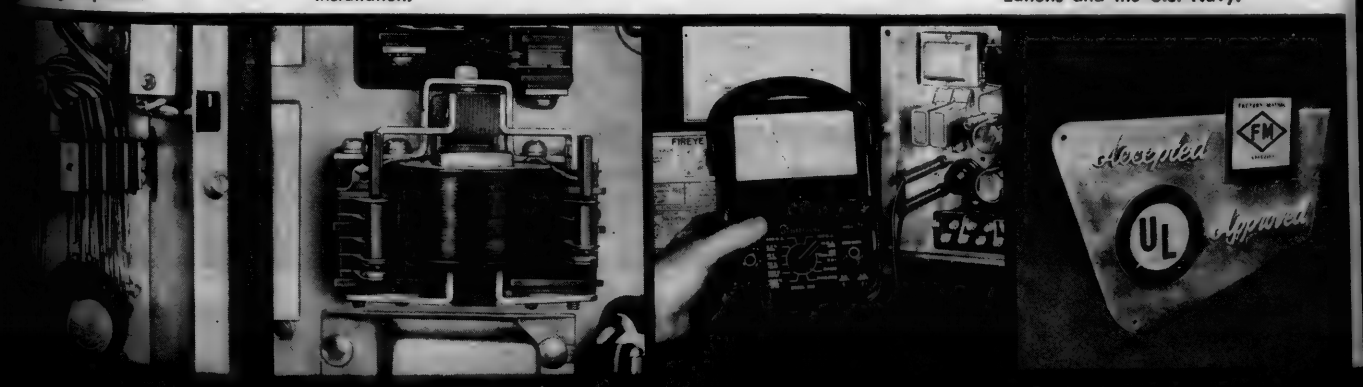
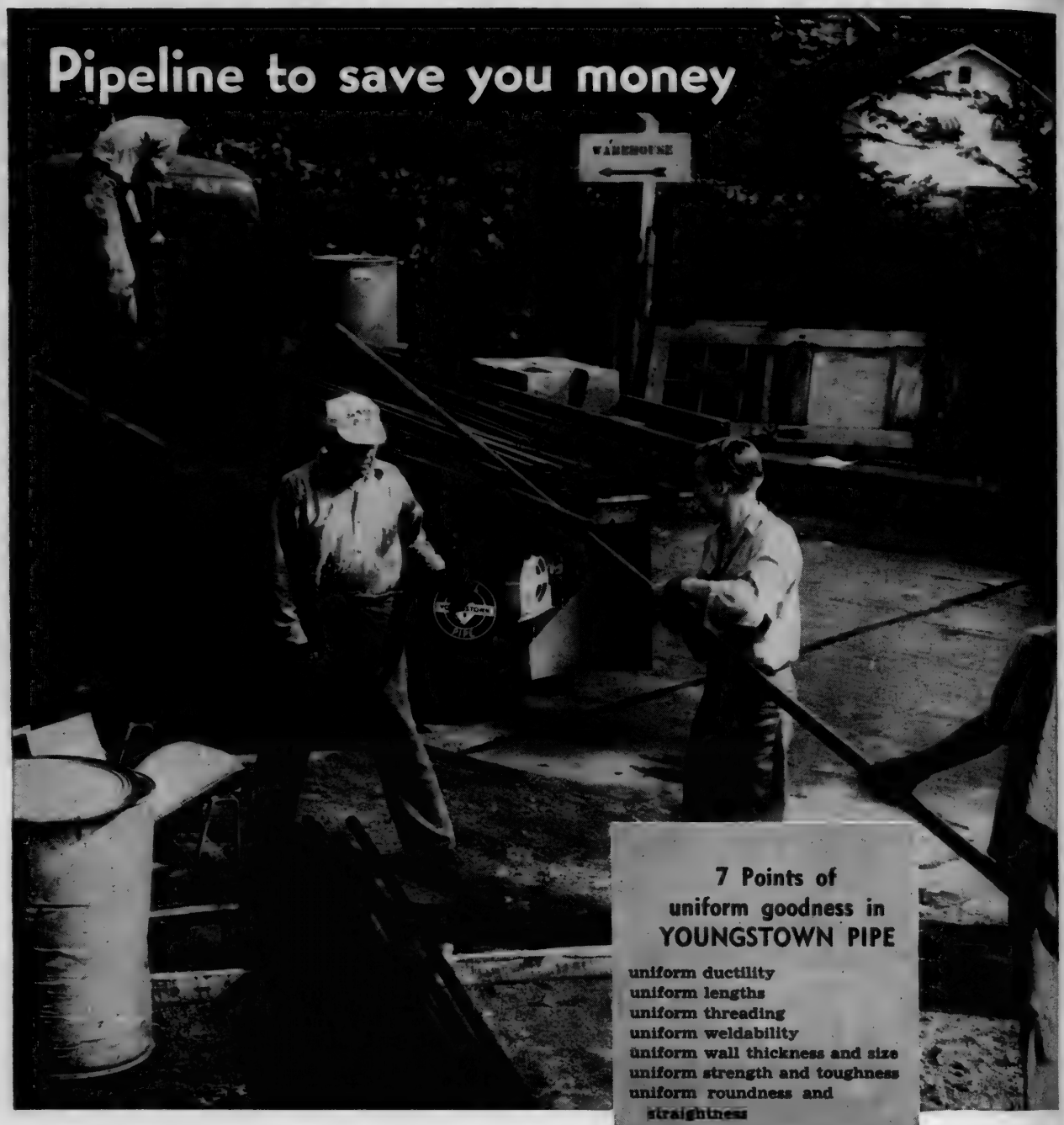
Laminated core MASTER RELAY has vacuum impregnated coil, electrolytic fine silver contacts with extra-heavy contact pressures. Built to outlast the burner installation.

Convenient TEST JACKS permit use of inexpensive DC voltmeter for complete system check without interrupting operation.

FACTORY MUTUAL and UNDERWRITERS' LABORATORIES approval attest to excellence of design and ruggedness. Accepted by all industrial insurance organizations and the U.S. Navy.



Pipeline to save you money



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NEW

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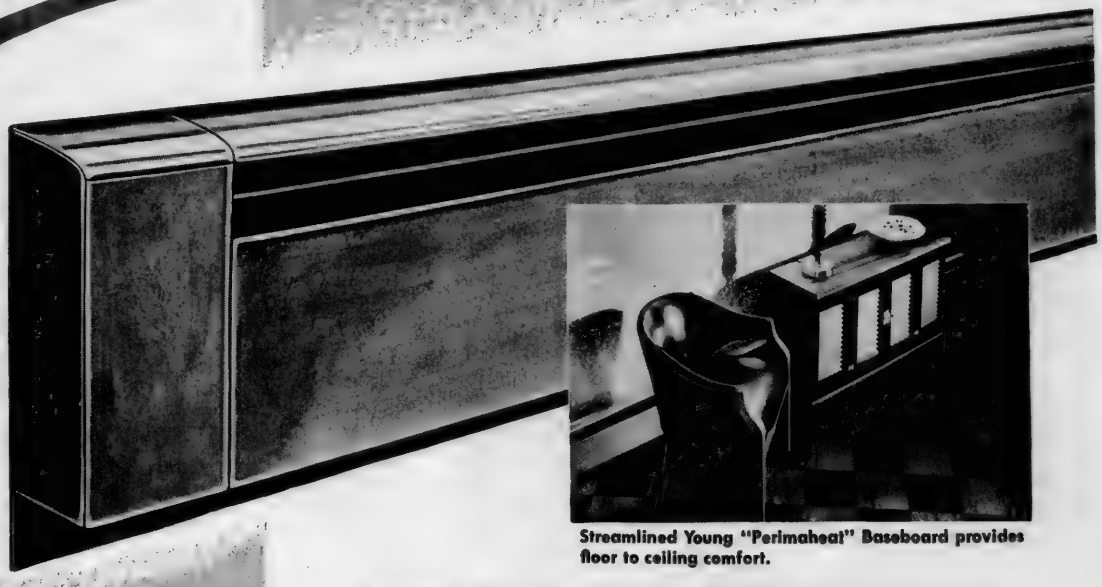
YOUNG "PERIMAHEAT"* Baseboard Meets Your Heating Requirements



Streamlined Young "Perimaheat" Baseboard provides floor to ceiling comfort.

Young "Perimaheat" Features Provide:

- **MAXIMUM HEATING CAPACITY**
- **QUICK, EASY INSTALLATION**
- **SLIM, MODERN CABINET STYLING**
- **MAXIMUM CLEANLINESS**
- **LOW FIRST COST**

YOUNG

• Efficient Young "Perimaheat" Baseboard Convectors represent the latest in modern, space-saving heating . . . especially designed to meet architects, engineer and contractor requirements. Made to harmonize with all types of construction, "Perimaheat" is packaged in lightweight sections, and installs quickly and easily. Non-ferrous heating element provides instant heat response with draft-free convected and radiant heat combating cold at outside walls. Heated air is discharged away from walls and drapes for maximum cleanliness. Knob-controlled damper permits individual room temperature control. For complete information, write for free Young Radiator Company "Perimaheat" Catalog described below.

*Trade Mark

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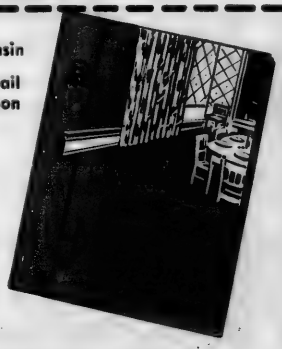
YOUNG RADIATOR COMPANY, Dept. 524-M, Racine, Wisconsin

Please send me this new catalog which describes in detail Young "Perimaheat" baseboard features, capacity, dimension and installation data.



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NEW "Small" boiler is a Big Quality package!

Available up to 150 hp — heating or processing — steam or hot water. A complete unit from a single source.

CLEAVER-BROOKS modern CB boiler

NO BOILER HAS EVER OFFERED SO MANY ADVANTAGES AND QUALITY FEATURES AT SUCH LOW INITIAL COST

• This NEW CB boiler has EVERYTHING needed to bring *big boiler standards* to commercial, industrial and institutional users with small capacity requirements. Despite its unusual, compact size you get big boiler performance — from matched-quality components, proved the world over on thousands of Cleaver-Brooks self-contained units.

Get all the facts NOW on how the new CB can help you save dollars. Make it a point to see . . . and *hear* the most silent-running, biggest boiler value available anywhere!

gives you all the quality features of time-tested self-contained design

- **FOUR-PASS FIRETUBE CONSTRUCTION** — longer gas travel scrubs heat from flame — means lower fuel costs — guaranteed efficiency of 80% when firing with oil.
- **SILENT OPERATION** — even at peak load this boiler more than meets the low sound levels required for schools, hospitals, institutions.
- **FULL FIVE SQUARE FEET** — of heating surface per boiler hp — for longer service life and low maintenance.
- **FUEL FLEXIBILITY** — burns available light oil, gas, or combination oil/gas — simple, quick fuel changeover on oil/gas models.
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- **COOLER BOILER ROOM** — fiber glass blanket insulation and 16 gauge metal sectional lagging are non-corrosive, moisture and heat resistant.
- **FULLY APPROVED** — by Underwriter Laboratories; conforms to ASME codes; factory tested before shipment.

NOW—FIRST SIZES OF THE CB BOILER ARE MADE IN CANADA, TOO.

Call your nearest CB boiler representative (see your phone directory) or send for this illustrated catalog describing the NEW CB — designed by Cleaver-Brooks, originators of self-contained boilers.

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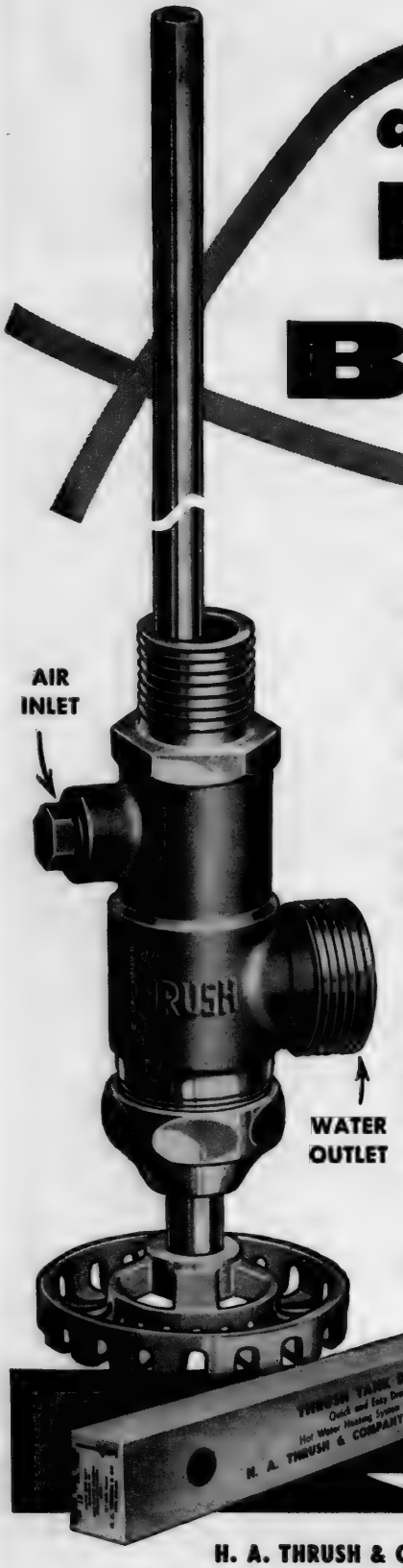
Cleaver-Brooks Company Dept. P-314 E. Keefe Ave., Milwaukee 12, Wisconsin, U.S.A.
Cable Address: CLEBRO — Milwaukee — All Codes.
Originators of the Self-Contained Boiler

a real... PROFIT BUILDER



You can sell a THRUSH Tank Drain for every expansion tank on any existing installation

YOU CAN SAVE your customer money, save yourself time and bother... and make a profit, too, by selling and installing Thrush Tank Drain. This simple, inexpensive Tank Drain combines an air tube with a drain and fits any drain tapping. Two lengths of tube are available.

REDUCES DRAINING TIME!

Draining waterlogged expansion tanks is simple, quick and positive with a Thrush Tank Drain. While all genuine Thrush Pressure Tanks now have Thrush Vacuum Breaker, there are many old installations where the tank has only one drain tapping. Sell them a Thrush Tank Drain. Just screw it into the drain tapping. Then remove the air inlet plug to break the vacuum and open the water outlet. The tank will drain quickly and completely. It's a profit item you can sell every day. For more information see your wholesaler or use the coupon below.

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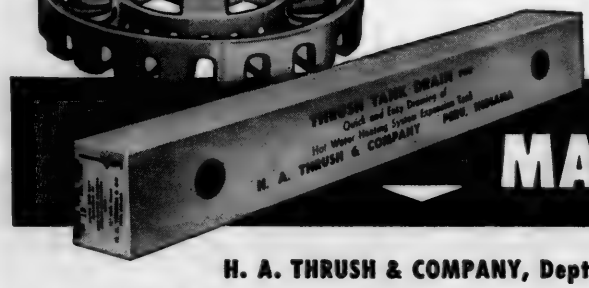

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H. A. THRUSH & COMPANY, Dept. D-12, PERU, INDIANA

Please send, without obligation, more information on the Thrush Tank Drain.

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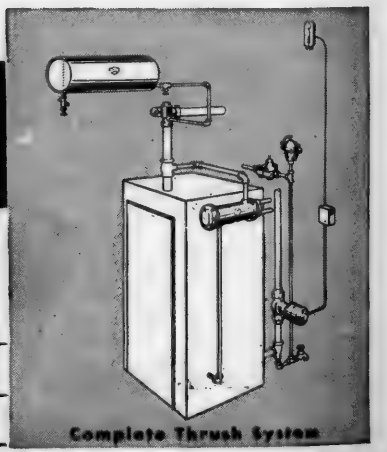
Complete Thrush System

Why it pays to specify *The Leading Brand*

YOU SAVE three important ways when you specify TUBE-TURN Welding Fitting and Flanges. (1) You get the most advanced products available . . . assured by Tube Turns' pioneering research. (2) You get the exact fitting and flange for *your* problem promptly because Tube Turns has the world's most complete line . . . available nearby. (3) You get piping ideas through the outstanding Engineering Service and how-to-do-it information of Tube Turns.

These money-saving extras are yours when you specify "TUBE-TURN". Call your nearby Tube Turns' Distributor.

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TUBE TURNS' *Engineering Service* helps save $50,000

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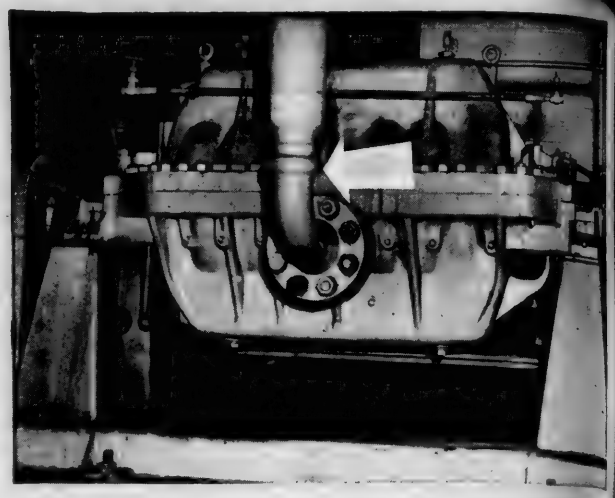
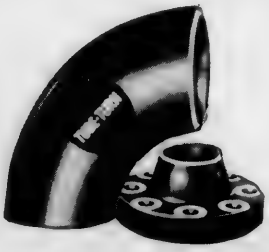
THE JOB. Brazing TUBE-TURN Aluminum Returns to aluminum tubing for cooling coils.



NEW HYDRAULIC COUPLING. This unique new TUBE-TURN Coupling for hydraulic piping eliminates weld scale and protrusions at joints, protects pumps and other precision equipment for lowest-cost operation. You are sure to get the latest cost-saving developments in fittings and flanges when you specify "TUBE-TURN".

YOU GET COMPLETE SERVICE. Your nearby Tube Turns' Distributor gives you the *exact* answer to your specific piping problem from the world's most complete line of welding fittings and flanges. It includes more than 4000 items . . . in all piping materials, schedules and sizes. This service is backed up by Tube Turns' engineering assistance.



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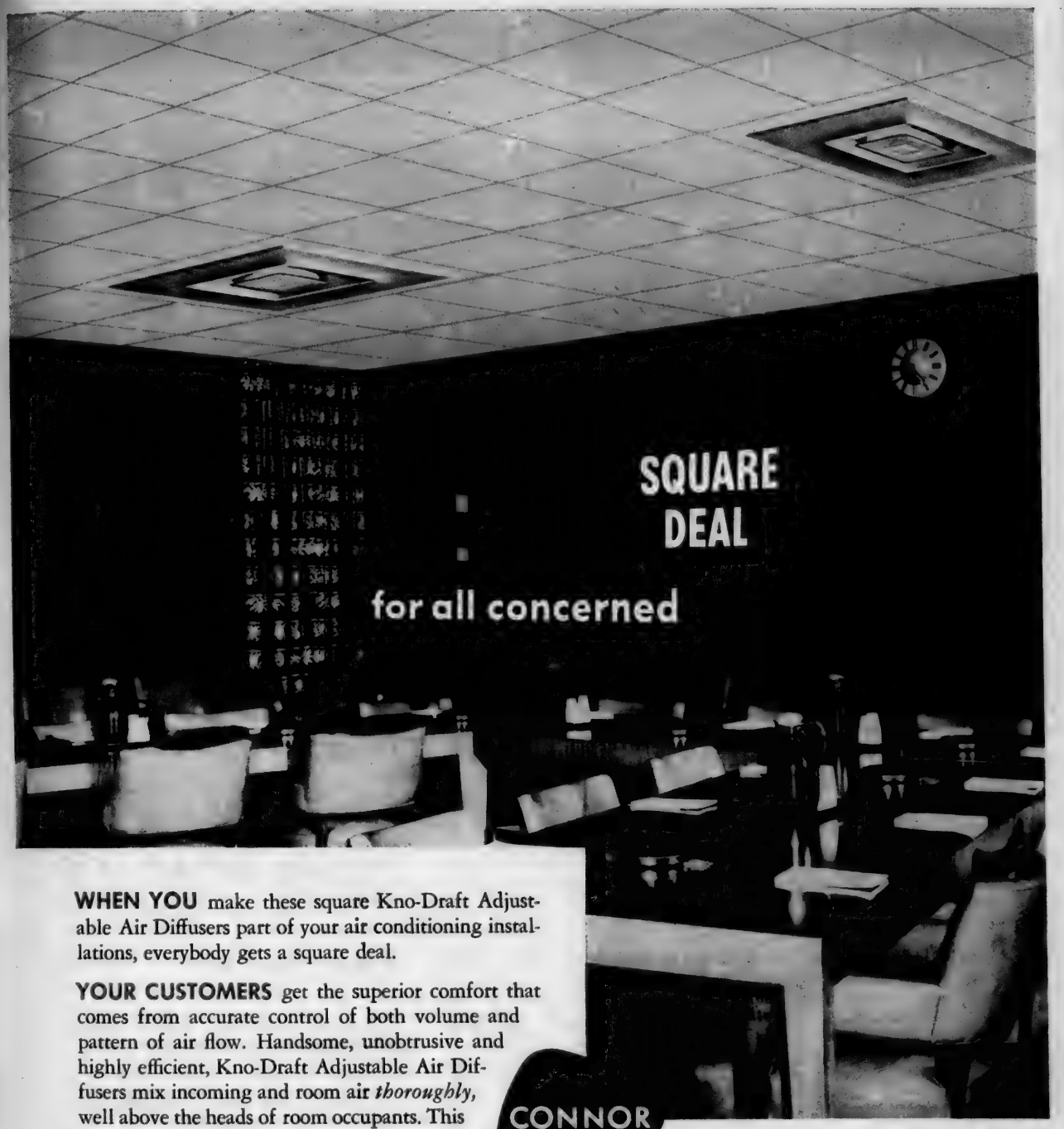

WHEN YOU make these square Kno-Draft Adjustable Air Diffusers part of your air conditioning installations, everybody gets a square deal.

YOUR CUSTOMERS get the superior comfort that comes from accurate control of both volume and pattern of air flow. Handsome, unobtrusive and highly efficient, Kno-Draft Adjustable Air Diffusers mix incoming and room air *thoroughly,* well above the heads of room occupants. This means even temperature throughout the conditioned area — *no drafts.*

YOU have more to offer and less "engineering" to do. Kno-Draft Diffusers are adjustable *after* installation. This means less slide-rule work *before* the job goes in. It also means easy resetting to accommodate future layout changes. Installation in any type of ceiling is quick and easy.

You can get Kno-Draft Adjustable Air Diffusers in round as well as square units. For complete specifications, engineering and installation data, send for the Kno-Draft Data Book. Just clip the coupon to your letterhead and mail to Connor Engineering Corporation, Danbury, Connecticut.

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adjustable air diffusers

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Please send me the latest edition of the Kno-Draft Data Book. No obligation, of course.

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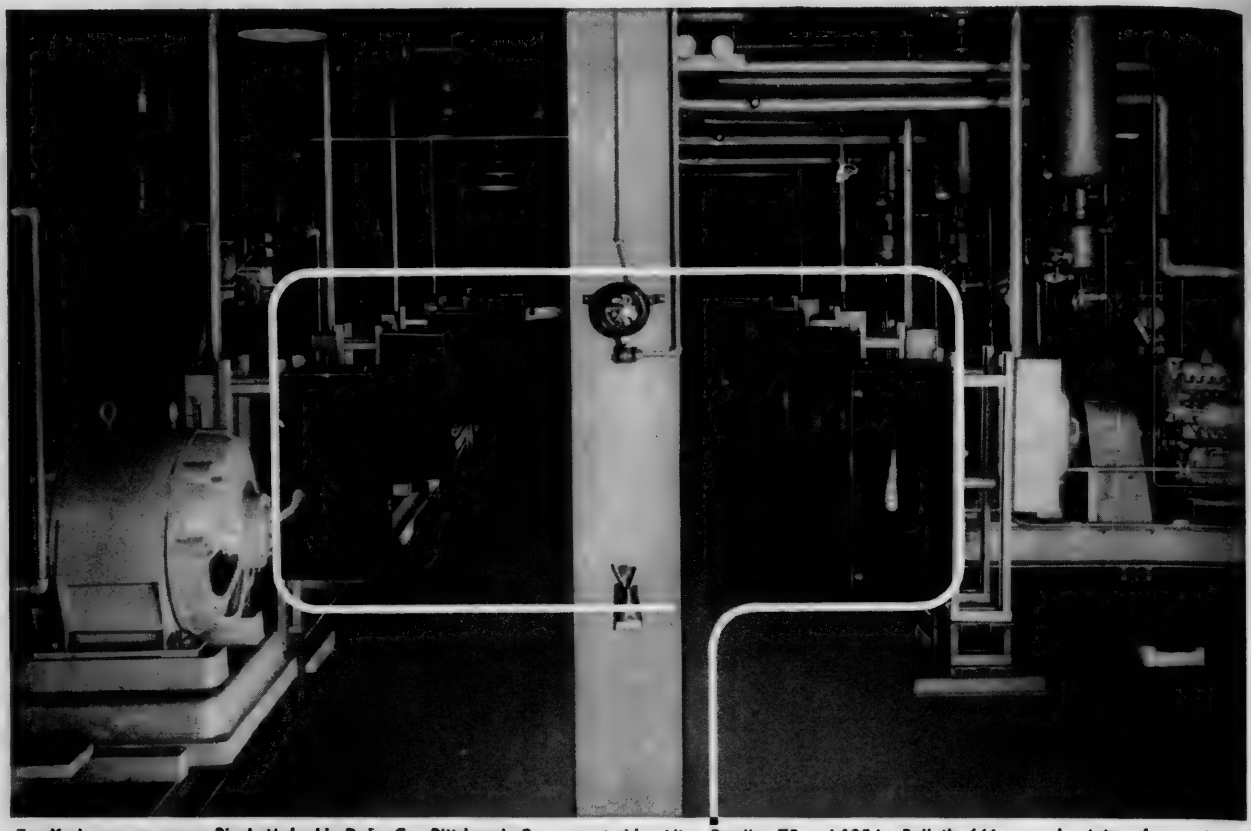

Ten York compressors at Rieck-McJunkin Dairy Co., Pittsburgh, Pa., operated by Allen-Bradley 75 and 125 hp Bulletin 646 manual autotransformer starters

York Compressors operated by...

When you buy a manually operated autotransformer starter, don't overlook these three big advantages of Allen-Bradley Bulletin 646 Starters:

(1) An adjustable time-delay switchover unit with gong to signal end of starting period after which the starting lever can be put into run position.

(2) Bulletin 646 Starters are listed with air break contacts up to 75 hp, 220 v; 150 hp, 440-550 v. They can be furnished with oil-immersed contacts, if desired. However, oil is messy and should be used only where local conditions require it.

(3) Allen-Bradley double break, silver alloy contacts, used with air break Bulletin 646 Starters, require no cleaning, filing, or dressing. This lengthens contact life.

Starting voltage taps are clearly labeled and easily adjusted to suit starting conditions. Time delay under-voltage release is optional.

On your next job requiring a manual, reduced voltage starter, specify "Allen-Bradley Bulletin 646."

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1330 S. Second St., Milwaukee 4, Wis.
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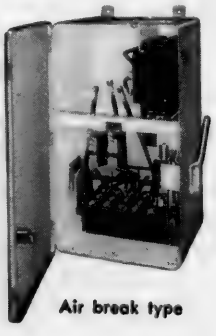
ALLEN-BRADLEY

Trouble-Free Motor Controls

BULLETIN 646 MANUAL AUTOTRANSFORMER STARTER

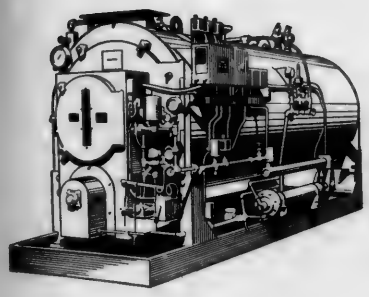


Air break type

A-B Quality

Allen-Bradley Solenoid Motor Controls

for Heating, Ventilating, Air Conditioning, and Refrigeration Industries



An Engineer Tells WHY Continental Boiler Tube-Sheets Have Long Service Life

"Pictured here is the rear tube-sheet of a packaged boiler, where the combustion gases at high temperature emerge from the furnace and sweep over the tube-sheet to enter the return tubes. Tube-sheet and tube ends are exposed to intense heat which may overheat the metal and cause serious damage.

"Tough problem . . . but the Continental features a simple solution:

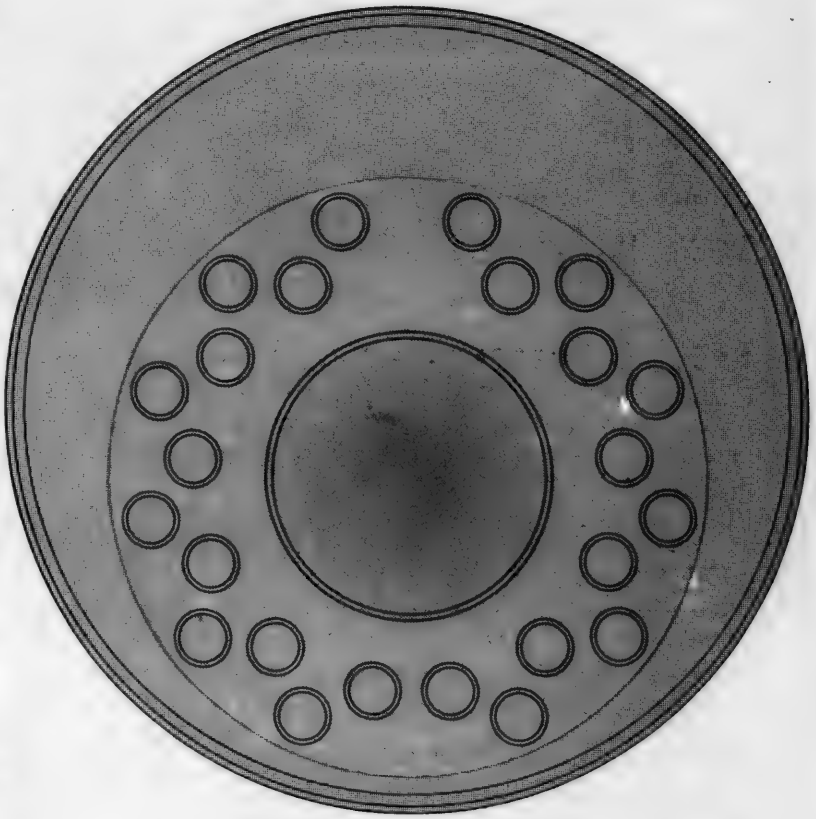
"(1) It provides equal flow of combustion gases to all return tubes so that all heating surfaces are equally effective.

"The Continental Boiler's two-pass design enables the hot combustion gases to transmit heat uniformly to the tube-sheet and tubes, thus making all surfaces equally effective.

"(2) The Continental Boiler provides adequate water circulation by proper arrangement of furnace and return tubes.

"It is essential that the large amount of heat carried to the tube-sheet and tube ends be quickly transferred to and absorbed by the boiler water. Sluggish circulation caused by close packing of return tubes may cause a heat block — with resultant overheating and damage to the metal.

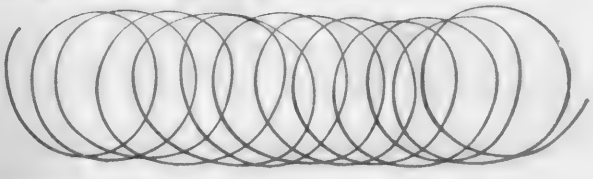
"Note the symmetry of tube layout in the Continental Boiler. There is uniform distribution of heat over the entire tube-sheet . . . equal loading of all return tubes . . . free and balanced water circulation space — with single pass of return tubes."



EFFICIENCY — guaranteed over 80% for all sizes of Continental Boilers, from 20 to 500 hp. Dependable, trouble-free operation — for steam heating at pressures from 15 to 250 pounds . . . or for hot water heating at low or high temperatures.

Write for Bulletins BE3 and BE4.

CONTINENTAL . . .
the boiler with the spinning gas technique



CONTINENTAL
Automatic Boiler
Manufactured by:
BOILER ENGINEERING & SUPPLY CO., INC.
Phoenixville, Pa.

AIR POLLUTION

Dust Covered Cars Offer *VISUAL PROOF* That a Dust Control Problem Is Just *HALF LICKED*

TAKE a look at the cars in your parking lot. They quickly show the effects of settled materials, many of which damage automotive finishes in surprisingly short periods of contact time.

If such dust is a source of irritation and expense to your employees, you can be sure that it is equally offensive to the surrounding neighborhood.

It's a problem resulting from half-way measures —solving inside dust problems at the expense of outside areas.

The solution is *complete* dust control as provided by AAF equipment. Dynamic precipitators, hydrostatic precipitators, dry centrifugals, fabric arresters—you'll find them all in the AAF line. There's a unit to cope with *any* type of dust—*completely*.

Let your parking lot be the metering device for dust conditions in your plant area. Your local AAF representative will check your dust sources and recommend effective, economical means of control. Call him today or write us direct.

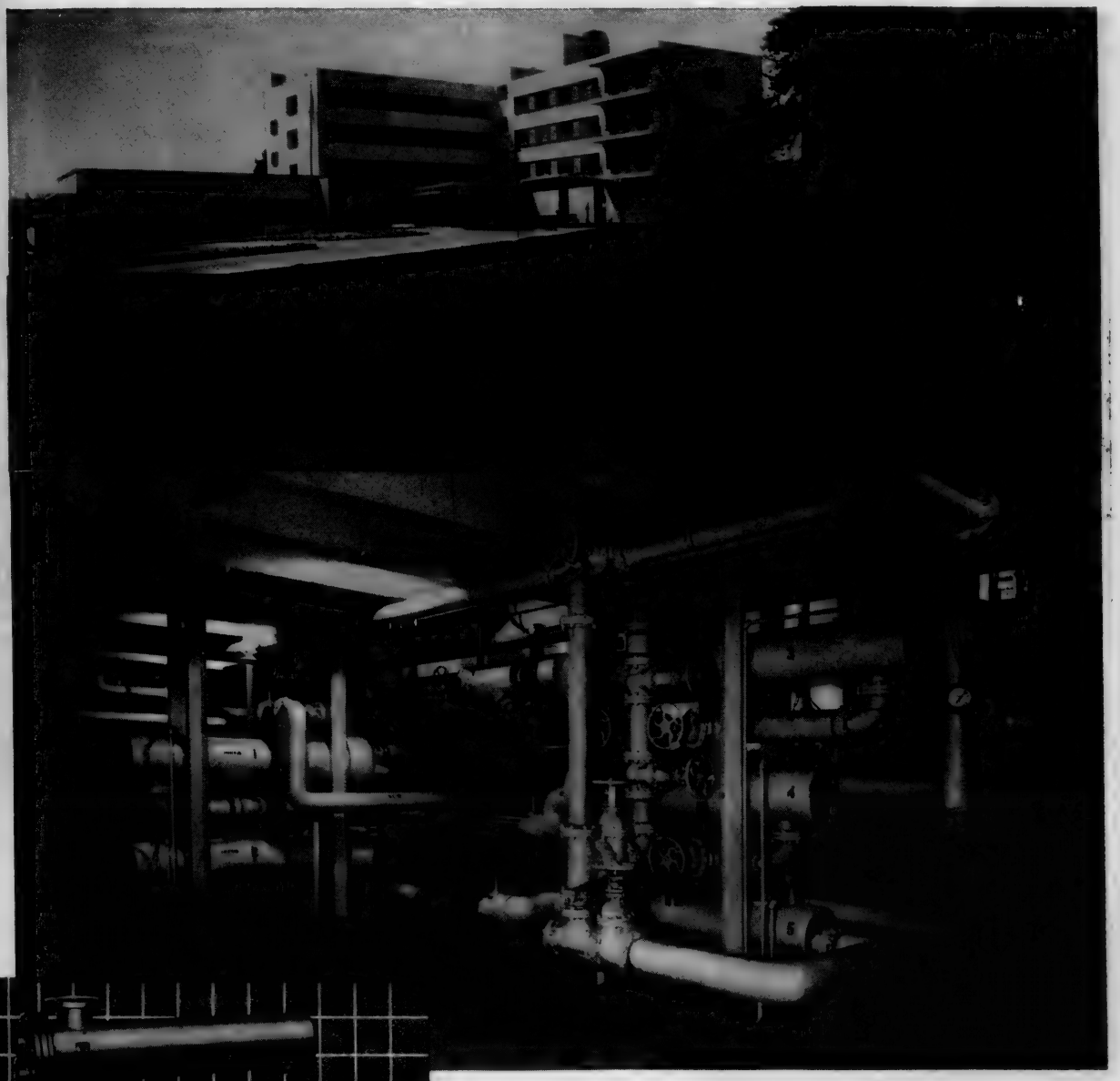
AAF EQUIPMENT DOES THE *COMPLETE* JOB —INSIDE *AND* OUT.

AAF

American Air Filter

COMPANY, INC.

American Air Filter of Canada, Ltd., Montreal, P. Q. • 284 Central Avenue, Louisville 8, Kentucky



B&G EQUIPMENT USED IN PENINSULA HOSPITAL

Seven "SU" Heat Exchangers • four Universal Pumps • four 1½" High Velocity Boosters • three 1¼" Boosters • two HD-3" Boosters • two PD-35 Boosters

This is an excellent example of a forced hot water space heating system in a building where steam boilers must be installed for process work.

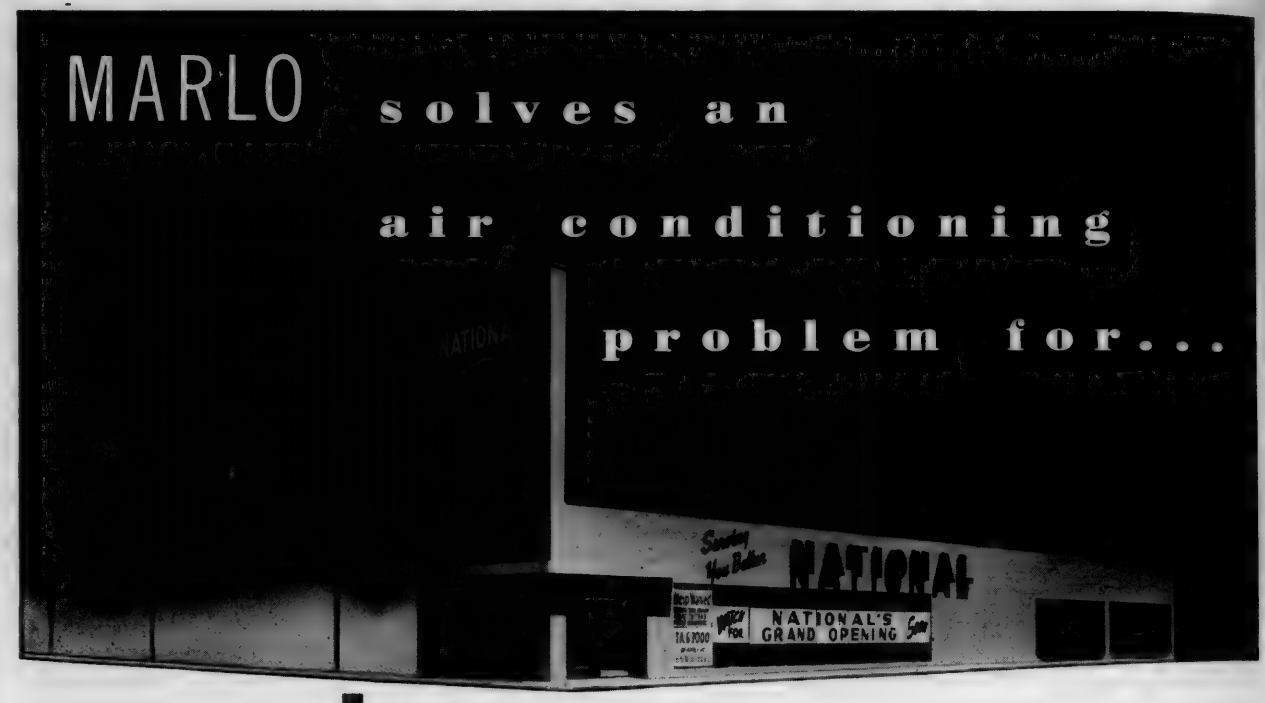
In the Peninsula Hospital, B & G Type "SU" steam-to-water Heat Exchangers are used to supply hot water for the space heating system. The reverse return piping plan is divided into four individually controlled zones equipped with convector heating units. This method affords all the benefits of forced hot water heating without the expense of extra boilers.

Service hot water is produced in two ways. During the day it is heated by steam from the laundry boiler in an "SU" Exchanger. At night, it is heated by hot water from the space heating system circulated through "SU" Exchangers adapted for water-to-water heat transfer by removing the baffles.

Send for catalog of B & G Hydro-Flo Heating Products

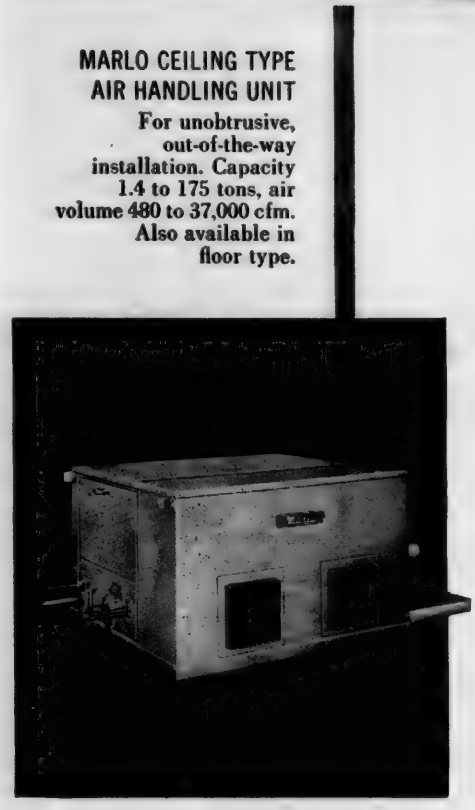
BELL & GOSSETT
COMPANY
Dept. DR-4, Morton Grove, Illinois
Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto, Canada

*Reg. U. S. Pat. Off.



MARLO CEILING TYPE AIR HANDLING UNIT

For unobtrusive, out-of-the-way installation. Capacity 1.4 to 175 tons, air volume 480 to 37,000 cfm. Also available in floor type.



NATIONAL FOOD STORES

In modern supermarket operation, every square foot of space must count.

That's why Marlo's Ceiling Type Air Handling Units were such a "natural" for the newest Detroit outlet of National Food Stores. Suspended from the ceiling, these compact Marlo units release badly needed floor space for storage or other uses.

In the past year, 16 National stores in the Detroit area have been equipped with this dependable, *practical* Marlo equipment for year-round air conditioning.

If you have an air conditioning problem, you'll find the solution in the complete line of Marlo quality equipment. Ask your architect or engineer, or write to Marlo today.

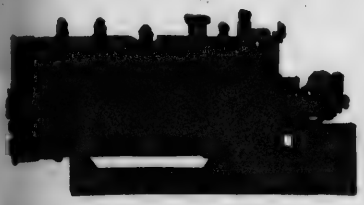
Write to Marlo today for Complete Information.

Marlo COIL COMPANY

Manufacturers of COOLING TOWERS • EVAPORATIVE CONDENSERS • INDUSTRIAL COOLERS • AIR CONDITIONING UNITS • MULTI-ZONE UNITS • BLAST HEATING & COOLING COILS

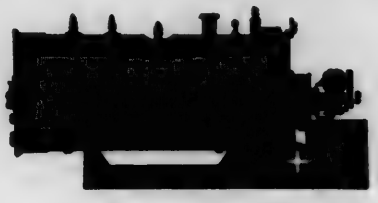
Saint Louis 10, Missouri

HOW SUPERIOR SOLVES YOUR STEAM PROBLEMS



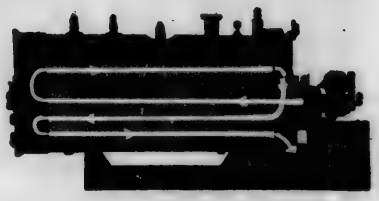
A COMPLETE PACKAGE

Completely factory-assembled and tested, a Superior Steam Generator is backed by undivided responsibility.



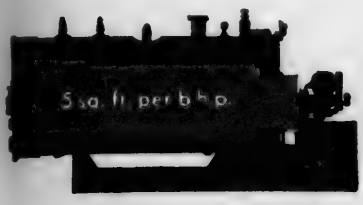
INDUCED DRAFT THAT'S BUILT-IN

... eliminates need of an expensive chimney ... Multiple fans draw evenly on all tubes, reducing maintenance.



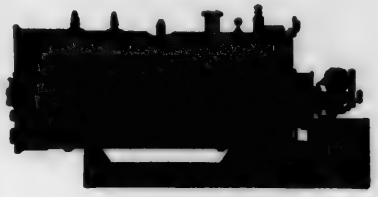
4-PASS, DOWN-DRAFT DESIGN

High gas velocities produce high efficiency. Down-draft design promotes rapid evaporation, quicker steaming.



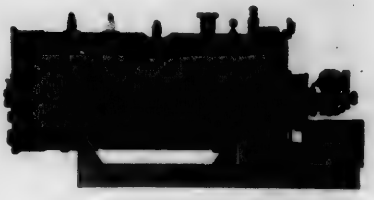
AMPLE HEATING SURFACE

A minimum of 5 sq. ft. of heating surface per boiler horsepower assures maximum efficiency at full rated capacity.



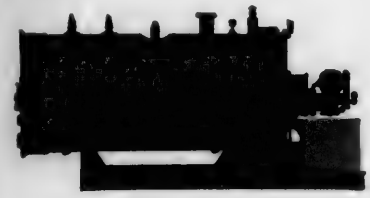
RESERVE CAPACITY

Greater steam space and large evaporating surface provide ample reserve capacity & better than 99% dry steam.



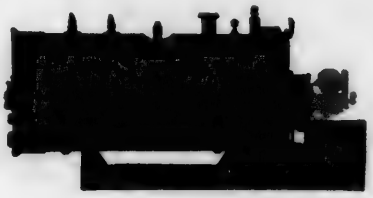
NO EXPENSIVE FOUNDATION

Built on a rigid channel iron base, a Superior Steam Generator needs only a floor capable of supporting its weight.



BUILT-IN CONTROLS

All controls essential to completely automatic operation are factory-wired into an easily accessible control panel.



BURN OIL, GAS, OR BOTH

Superior Burners burn oil or gas or a combination of both ... changing from one fuel to the other in seconds.

Superior Steam Generators are the ideal choice for a new steam plant ... the simplest answer to expanding your present plant ... the easiest solution to replacing obsolete boilers.

Guaranteed to develop maximum rated capacities at thermal efficiencies in excess of 80%, their design embodies features which insure long-lived dependability and maximum fuel economy.

for performance you can **BANK** *on*

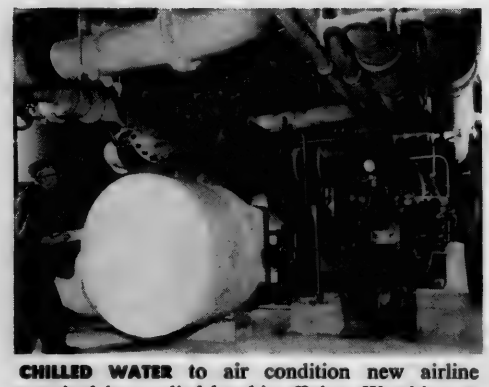
SUPERIOR
STEAM GENERATORS

18 sizes from 20 to 600 b.h.p. for pressures to 250 p.s.i. or for hot water. For complete details write for Catalog 619.

SUPERIOR COMBUSTION INDUSTRIES INC. TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

WORTHINGTON AIR CONDITIONING SYSTEM in New York's East Side airline terminal . . .

. . . cools 35,000 airline passengers a day



CHILLED WATER to air condition new airline terminal is supplied by this efficient Worthington centrifugal refrigeration unit.

Passengers stay cool and comfortable in New York City's brand-new airline terminal while waiting for their trip to the airport.

The joint enterprise of 23 leading airlines, the new terminal now serves over 35,000 people a day.

And for this modern building, nothing less than a truly modern air conditioning system would do. That's where Worthington came in. A Worthington-engineered, Worthington-built 315-ton centrifugal refrigeration system, along with Worthington air handling equipment and pumps, carries the entire cooling load for the terminal's 3,300,000 cubic feet of space.

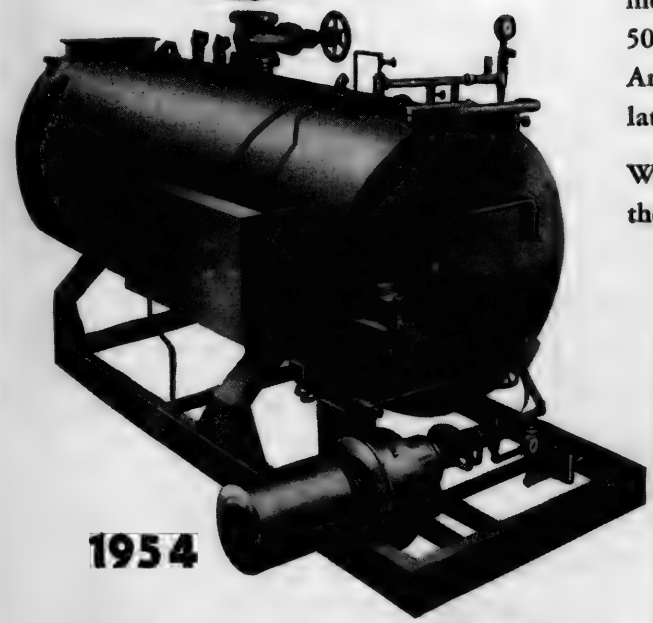
Worthington air conditioning equipment has been the choice of leaders in business and industry for over 50 years. For the reasons why, write Worthington Corporation, Air Conditioning and Refrigeration Division, Section A.4.51, Harrison, New Jersey. A.4.51

"SEE the Worthington Corporation Exhibit in New York City. A lively, informative display of product developments for industry, business and the home. Park Avenue and 41st Street."

WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME

106 YEARS of RELIABILITY ARE BEHIND EVERY AMESTEAM GENERATOR



AMESTEAM GENERATOR

20 sizes, 10 to 600 H.P., 15 to 200# W.P., oil, gas, or oil-gas combinations with quick fuel switchover feature.

In your selection of a boiler, it's important to remember — experience *does* count. And what better assurance of top boiler quality do you have than the Ames record: 106 years of building fine boilers — boilers which have given economical, satisfactory service throughout the industry! Many Ames units purchased 40 to 50 years ago are still faithfully on the job. Amesteam Generators always incorporate the latest advances in package boiler design.

Write today for details on these boilers with the proven record of reliability.

AMES IRON WORKS, INC.
Box C-124, Oswego, N. Y.

Show me how I can benefit from Ames experience and nation-wide organization in getting a top boiler value.

NAME.....

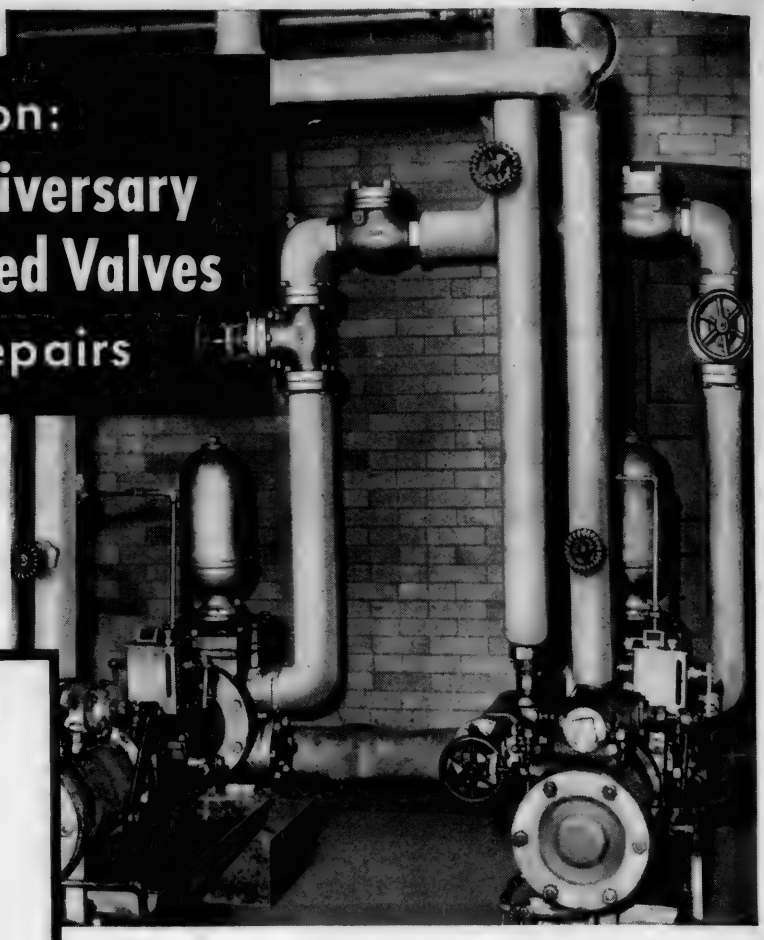
ADDRESS.....

COMPANY.....

Coming soon:

30th Service Anniversary for these Boiler Feed Valves

... and still no repairs



The Installation

At the St. Joseph Manual Training and Industrial School, Lisle, Ill., where installation of Crane gate and check valves on boiler feed pumps was made in 1925. Working pressure approximately 110 psi water.

Valve Service Ratings

SUITABILITY:
Best for the purpose

FEATURES:
35% stronger body material

MAINTENANCE COST:
Zero—no repairs to date

SERVICE LIFE:
Still like new—since 1925

OPERATING RESULTS:
Trouble-free boiler water feeding

AVAILABILITY:
Regular Crane items—No. 3E Gate—No. 38E Check

The Valves

Even better than they were 30 years ago, today's Crane 250-pound iron valves continue to lead in quality and performance. They give you heavy-duty construction... finest workmanship down to the smallest detail... and the most simplified, dependable operating design. Their Crane Ferrosteel castings are 35% stronger than ordinary cast iron. Choose from your Crane Catalog—in gates, globes, and checks—all-iron or brass trimmed—in sizes up to 12 in. Or consult your Crane Representative.

No. 38E Check

The Case History

Even more significant than the 30 years' service, is the quality of performance of these Crane 250-Pound iron body gate and check valves. Never, since installed in 1925, have they needed repairs or maintenance, nor were they given more than customary routine care.

Still, the check valves continue to seat as tightly as the day they left the factory test rack. The gates, though infrequently operated, still work as smoothly and seat as surely as when new.

Even in valves for common services, big savings can be made by putting quality first when buying. Today, such a buying policy is sounder than ever—and that's why more and more buyers are standardizing on Crane quality valves.

THE BETTER QUALITY... BIGGER VALUE LINE... IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

Whatever you do...
don't miss the

American Blower
exhibit

at the

INTERNATIONAL EXPOSITION!

Booths 22 & 24

See

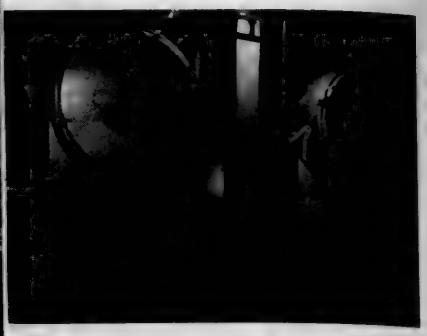
all new American Blower products for heating, ventilating, air conditioning!

Visit

the American Blower Exhibit at the International Heating and Ventilating Exposition at Commercial Museum, Philadelphia, January 24th through the 28th, 1955!

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary Corporation

Serving home and industry:
AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS



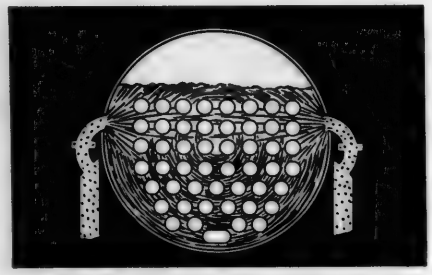
These two Pacific Boilers heat the building and temper water for the swimming pool at the Tulsa YMCA. Fuel consumption is lower because *Jet-action* Circulation maximizes heat transfer.

Tulsa's beautiful new YMCA is one of the most modern in the U.S.A. Architect—Leon B. Senter; Builder—Grimshaw Construction Co.; Mechanical Contractor—Watt Plumbing, Heating & Air Conditioning Co.; all of Tulsa, Okla.

New YMCA gets more heat for the money . . . uses Pacific Boilers with *Jet-action* Circulation!

The new seven-story YMCA in Tulsa, Okla., provides many comforts of a luxury hotel. Yet, in true YMCA tradition, operating costs are kept low to make living and playing at the Y inexpensive. A major factor in keeping costs down are the Pacific Boilers that heat the building and temper water for the swimming pool.

Unlike ordinary boilers, Pacific Boilers have *Jet-action* Circulation to sweep away—and keep away—air and steam bubbles that cling to heating tubes and eat up fuel.



Steam and hot water are propelled at high speed across the heating tubes by Pacific's exclusive jet-like circulating connections. The tumbling turbulence of this *Jet-action* Circulation scrubs heating tubes clean . . . away go the insulating bubbles that impair heat transfer! Up goes efficiency! Down goes fuel consumption! And when temperature change is desired, the response is practically immediate!

Your customers will welcome the extra efficiency of *Jet-action* Circulation . . . and the lower fuel bills. For complete satisfaction, specify Pacific Boilers. They come in all sizes, using all fuels, for any type building, and are easy to install. Your local Pacific representative will gladly supply catalogs and engineering data. Call him today!

Designed Constructed and Stamped in Accordance with ASME Code

UNITED STATES RADIATOR CORPORATION: Boilers, Radiators, Heating Accessories • Pacific Boilers • Cyclotherm Steam Generators • Metal Products • Drayer-Hanson Air Conditioning and Commercial Refrigeration

Pacific Steel Boiler

DIVISION UNITED STATES RADIATOR CORPORATION

GENERAL OFFICES DETROIT 31, MICHIGAN

Profit with WEATHERBRAIN

the *completely mechanical* indoor-outdoor control for forced hot-water heating systems

Completely automatic • Inexpensive

No electronic tubes, relays or delicate mechanisms

Easily installed • Assures constant comfort

Now you can cash in on big, new profits in the hot water heating field with Detroit's amazing new Weatherbrain Control. That's because Weatherbrain indoor-outdoor control offers heating comfort never before possible in forced hot-water heating systems—constantly uniform and completely automatic with no manual adjustment required. The Weatherbrain Control's outdoor bulb senses changes in outside temperature and responds instantly by supplying the exact amount of heat to keep room temperature right where it should be! And because it is entirely mechanical in operation with no expensive, complicated electronic circuits, Weatherbrain Control costs less and is easily installed. See your Detroit Controls wholesaler today or write us direct at the factory for bulletin No. 254.

CHECK THESE FEATURES

- Varies the water temperature delivered to panels or radiation in exact accordance with the demands of the weather.
- Good for zone systems due to simplicity and reasonable cost.
- Gradual changes in water temperature in the system minimize the undesirable effects of thermal expansion and contraction.
- Very valuable where more than one type of radiation is used or domestic hot water is heated by the boiler, in which cases the electrical boiler resetting type control can not be used.

DETROIT CONTROLS *Corporation*

5900 TRUMBULL • DETROIT 8, MICHIGAN

Division of AMERICAN RADIATOR & STANDARD SANITARY Corporation

Representatives in Principal Cities • Canadian Representatives in Montreal, Toronto, Winnipeg—Railway and Engineering Specialties, Ltd.

AUTOMATIC CONTROLS for REFRIGERATION

AIR CONDITIONING • DOMESTIC HEATING • AVIATION • TRANSPORTATION • HOME APPLIANCES • INDUSTRIAL USES

Serving home and industry

AMERICAN STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • TUNNELAIR AIR CONDITIONERS

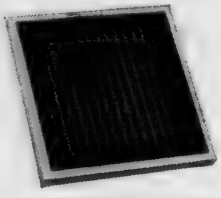
Random Thoughts from a Filter Engineer

by George Walton

- **WHAT MAKES "RECIRCULATED" AIR DIFFERENT?**
- **OCCASIONALLY WE SEND OUT A DEFECTIVE PART!**
- **SO MODERN IT STARRED IN A MOVIE!**

WHAT MAKES "RECIRCULATED" AIR DIFFERENT?

Most of the air filtered in this country is recirculated air. Home furnaces account for a large part of it. So does the practice of mixing recirculated air with fresh air in ventilating plenum chambers. All this recirculated air *is* different because it contains a good deal of bulky, linty material. This is important to keep in mind when selecting a filter because bulky, linty material usually creates problems such as rapid pressure-drop build up and difficulty in cleaning.

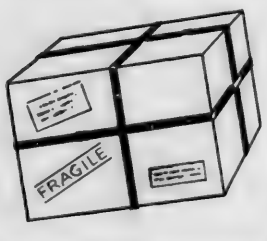


KLEENFLO FILTER

That's because the lint snags on the comparatively rough wire widely used in filter media, is hard to remove. We solved the problem in our Kleenflo filter by using smooth, round wire. And our Kleenflo has another design feature that makes it especially suited for recirculated air. Its specially pleated front face provides extra dirt collecting area to trap more linty material without undue pressure loss.

OCCASIONALLY WE SEND OUT A DEFECTIVE PART!

It's quite a confession for a manufacturer to make, but there it is—we've said it. In spite of checking and rechecking, in spite of inspectors who have been carefully trained, in spite of constant vigilance all along the line, we, like other manufacturers, occasionally crate up a defective part and send it to a customer.



We're not proud of the fact that we make mistakes. But we are proud of the fact that we back up every product we make. If our customer isn't completely satisfied, if the part in question is defective in the smallest degree, we take back the part and immediately replace it with a perfect one. And we don't make a great to-do about it, either. There are no questionnaires to fill out, no special conditions to fulfill. We simply take back the part and make it right.

This, of course, is nothing exceptional. Any reliable manufacturer will do the same for his product. The trick is to make sure the company you deal with is reliable—whether you're buying filters or fork trucks.

SO MODERN IT STARRED IN A MOVIE!

We've always thought our plant was pretty special. Recently something happened that helped confirm that belief. The plant starred in a TV movie! A local power company thought so much of our modern, up-to-date lighting system that they chose to use it as a model. So there we were, ultra-modern lighting system and all, big as life on TV!

Actually, there's a moral to this story. The rest of our plant is as modern as our lighting system. We use the most modern equipment, the most efficient methods. We know that men do a better job when their equipment and working conditions are tops. As a result, we think we have a far better chance of turning out quality products at a competitive price than a company using old-fashioned equipment and methods. We can give you more for your filter dollar.

AIR-MAZE PLANT

That Air-Maze *does* give you more is a matter of record. For 29 years we've made a specialty of giving customers extras in research, service, engineering. And at a reasonable price. The Air-Maze Corporation, 25000 Miles Avenue, Cleveland 28, Ohio.

AIR-MAZE

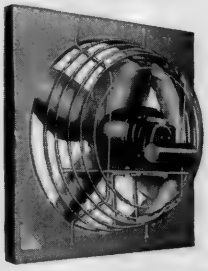
The Filter Engineers

AIR FILTERS • SILENCERS • SPARK ARRESTERS
LIQUID FILTERS • OIL SEPARATORS • GREASE FILTERS

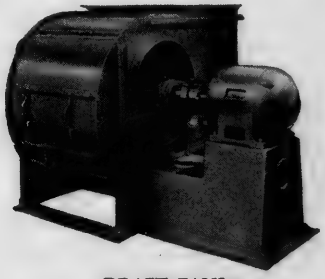
BEST GIFT for your PLANT

DEPENDABLE "BUFFALO" FANS with the FAMOUS "Q" Factor*

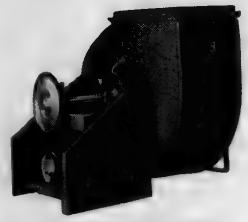
TYPE "BL" FANS
sizes for 1,000 to 500,000 cfm, these new non-overloading fans for general ventilation and air conditioning offer even finer performance than their famous predecessors, the "LL" Fans.
NEW BULLETIN F-100



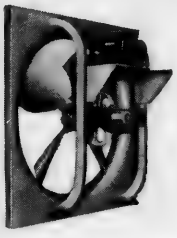
New! NV-BREEZO FANS
Their specially-shaped four-blade wheel gives high efficiency even against system pressures of ¼" and ½", 8" to 24" sizes.
BULLETIN 3865



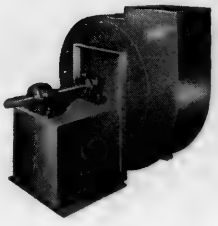
DRAFT FANS
"Buffalo" mechanical Draft Fans are helping turn out low-cost steam in plants and major utility stations everywhere.
BULLETIN 3750



BELTED VENT SETS
Non-overloading ventilating fans for duct or free air delivery. Extra quiet.
BULLETIN 3720

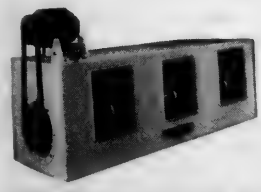


New! BELT-AIR FANS
Quiet, sturdy fans to move a lot of air at negligible cost. Heavy-gauge die-stamped blades and panel.
WRITE FOR DETAILS



INDUSTRIAL EXHAUSTERS
All-welded for strength and high efficiency. With air or material wheels.
BULLETIN 3576

"CB" PRESSURE BLOWERS
Up to 2¼ psi, single stage with these husky, space-saving units!
BULLETIN 3553



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Quiet, efficient, vibration-free fans. Wheels mounted on hollow shaft.
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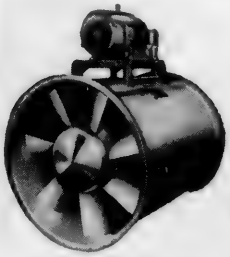

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Compact, light, highly efficient ventilating fans for light duty.
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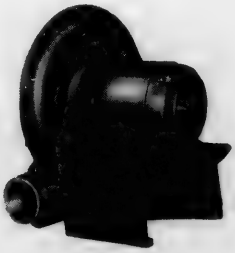

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For low to medium pressures and volumes in draft, cleaning, line boosting.
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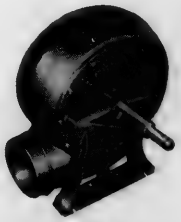

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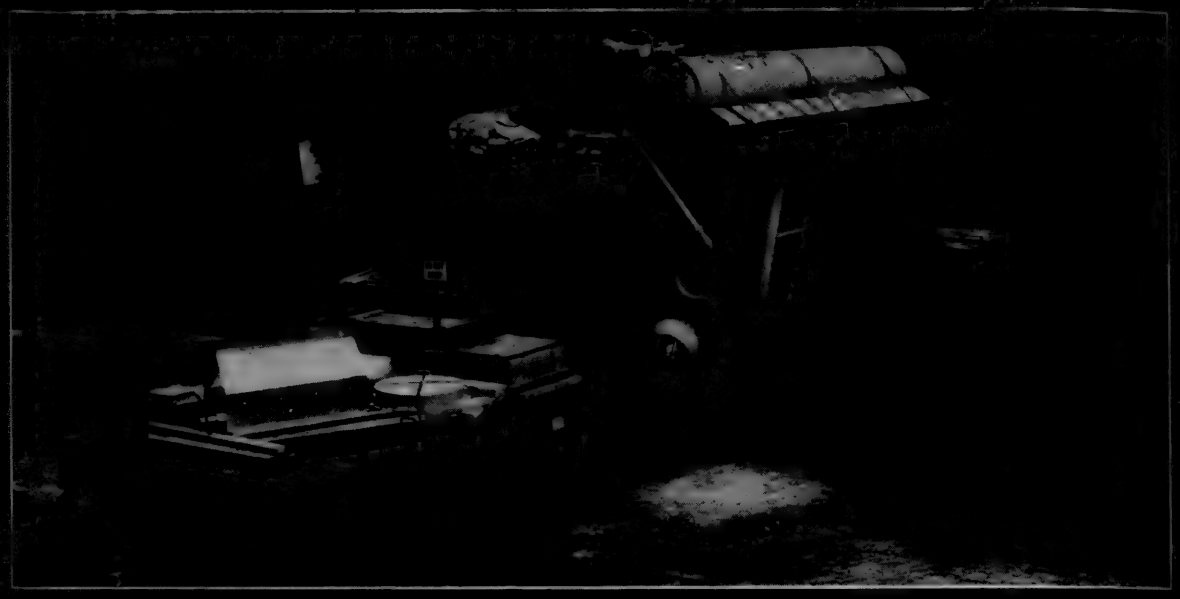

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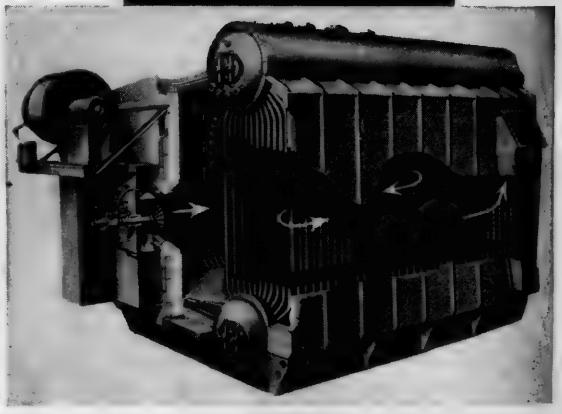

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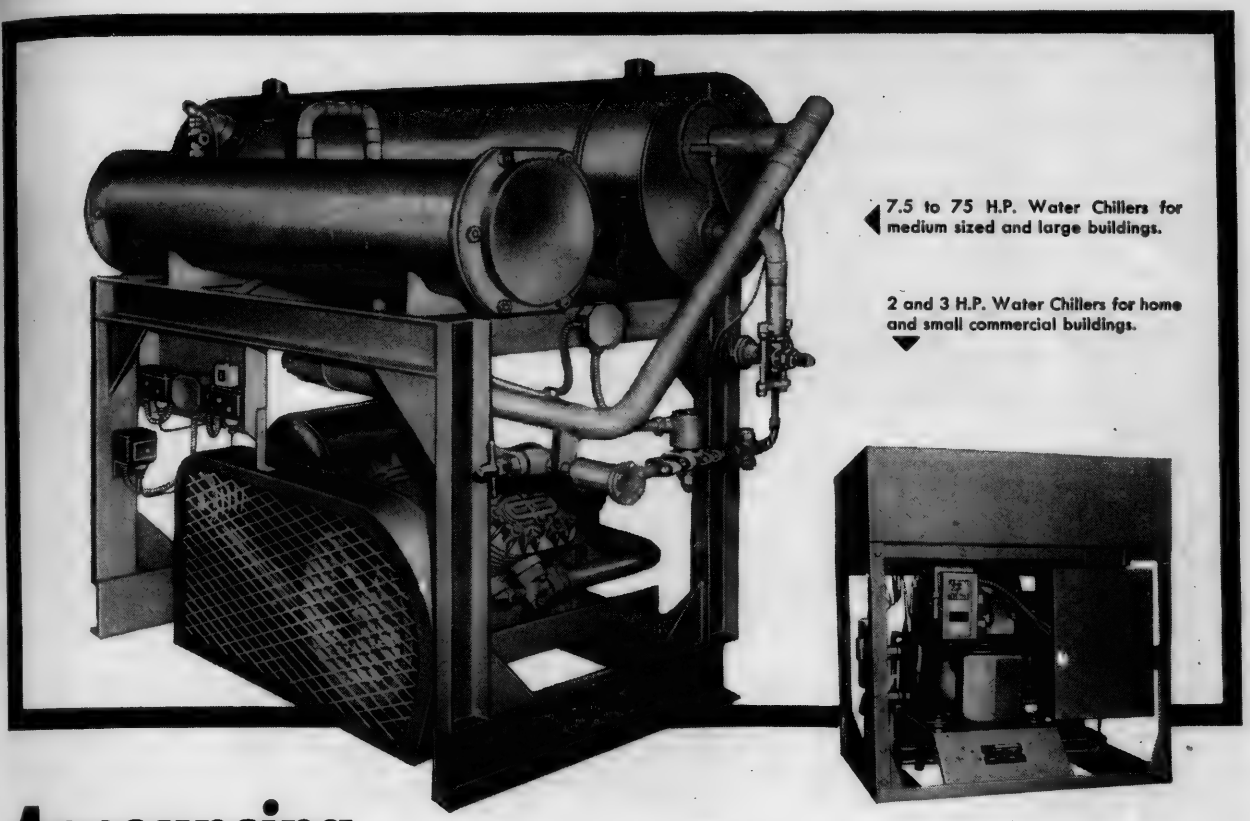
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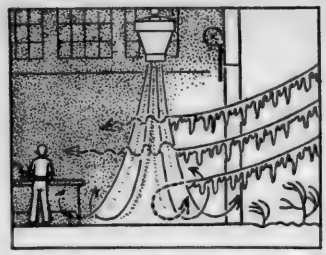

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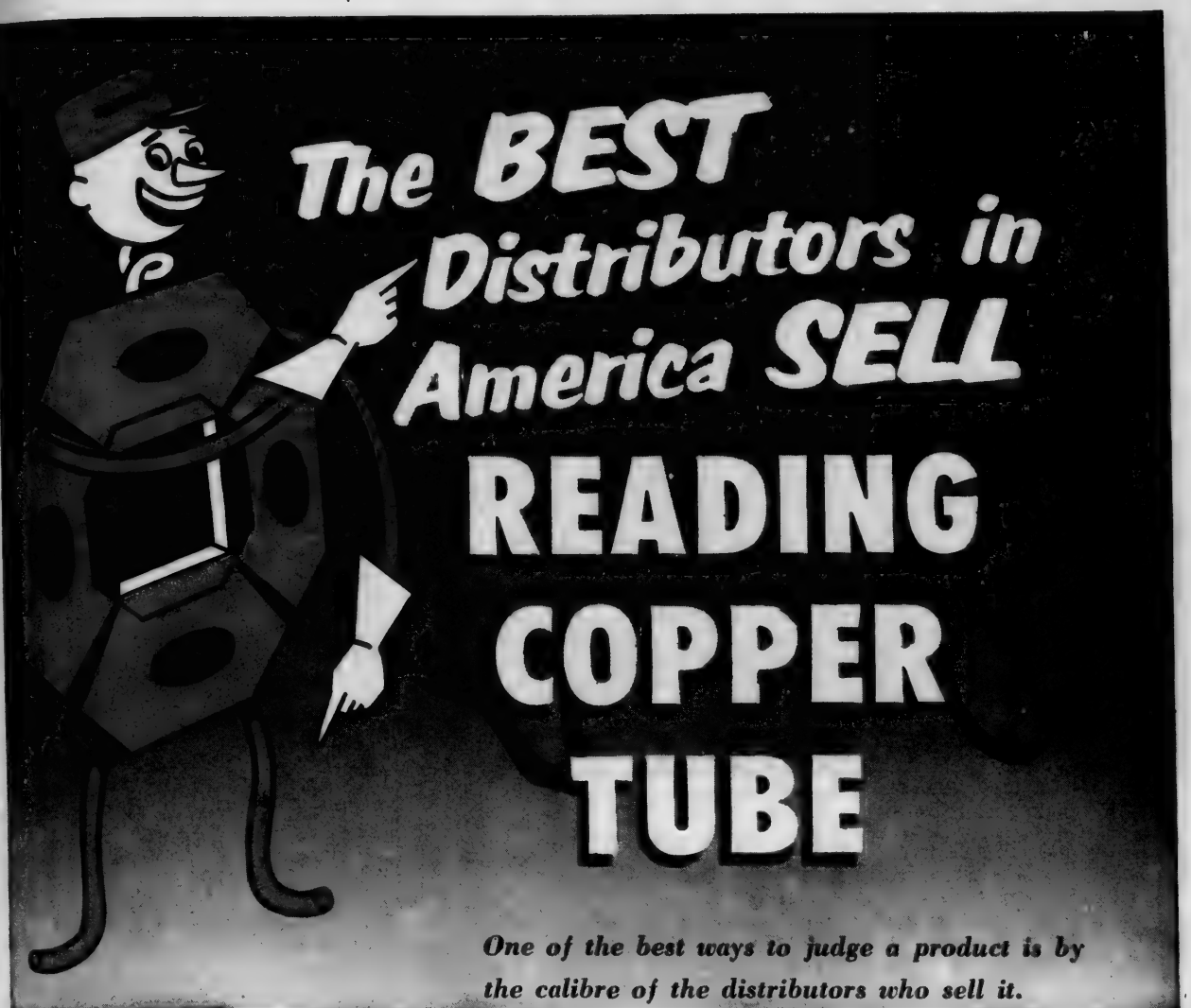

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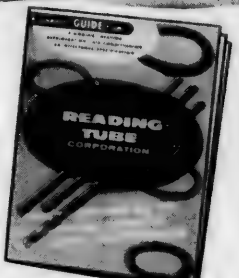

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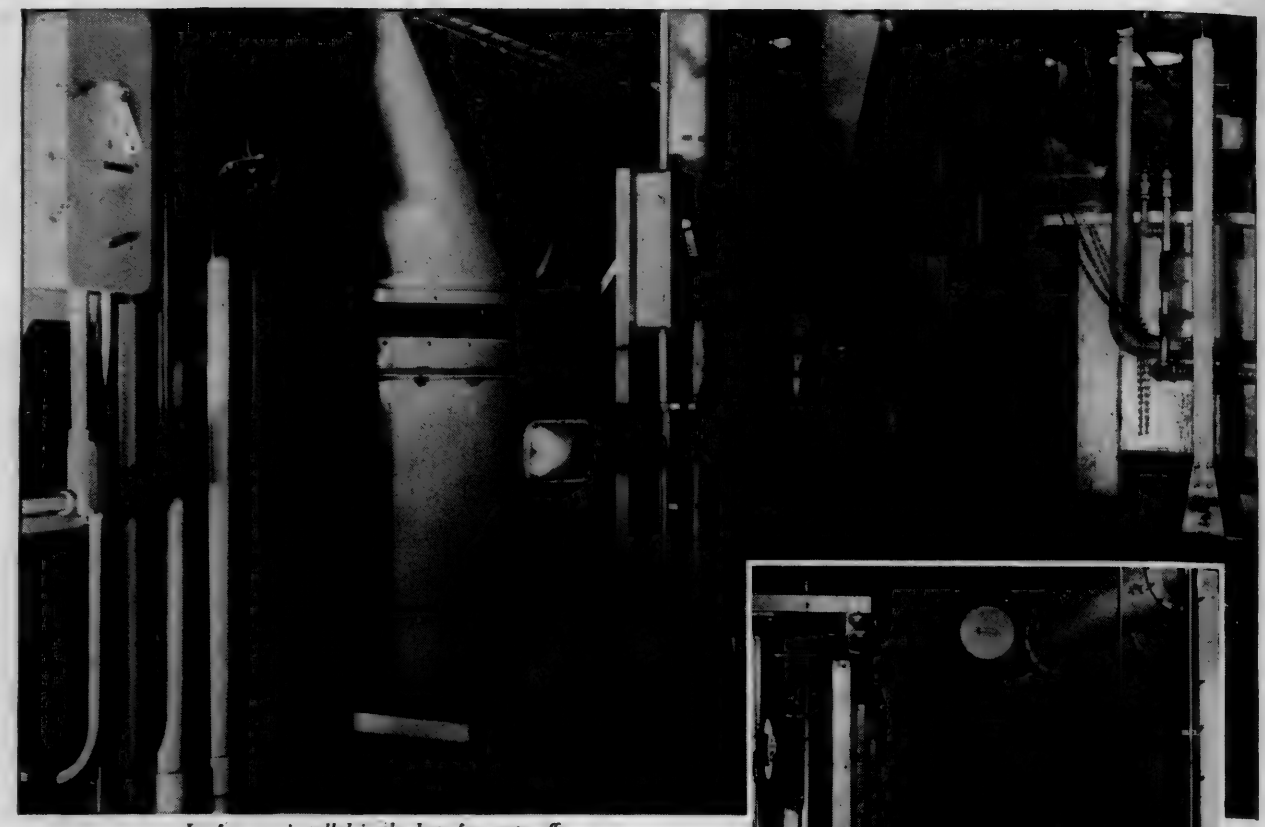
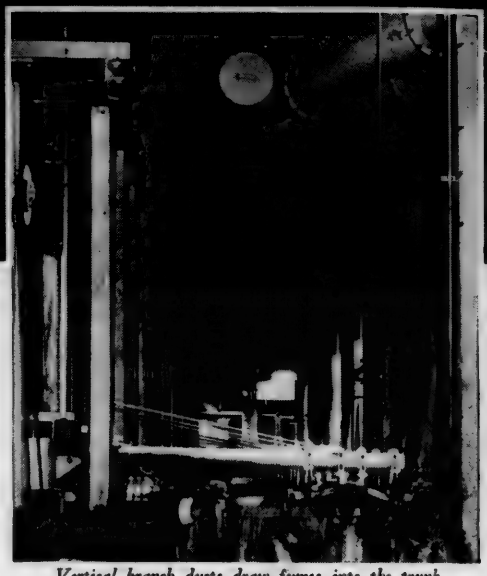


Joy fans are installed in the ducts for greater efficiency, easier installation, and economy of floor space.



Vertical branch ducts draw fumes into the trunk line for ultimate discharge into the atmosphere.

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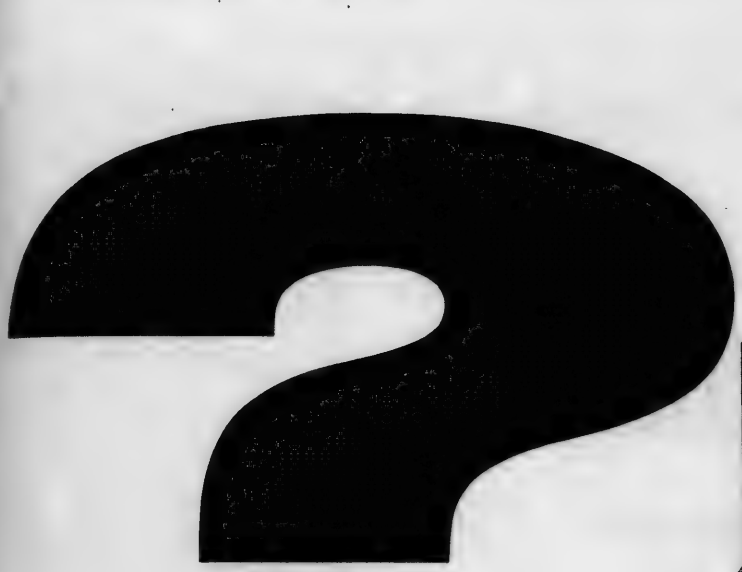

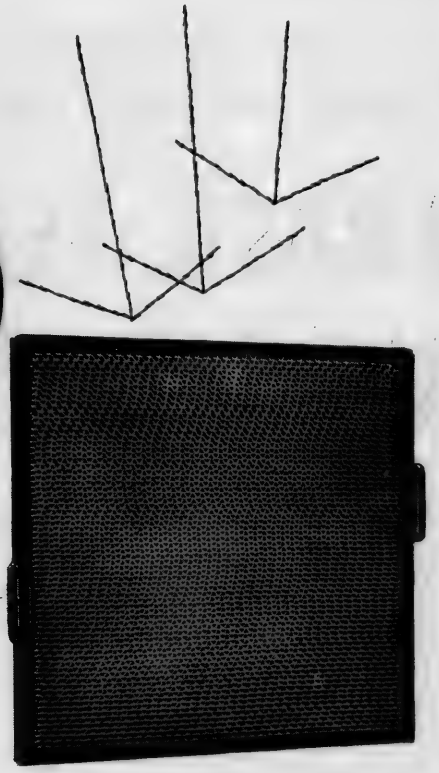

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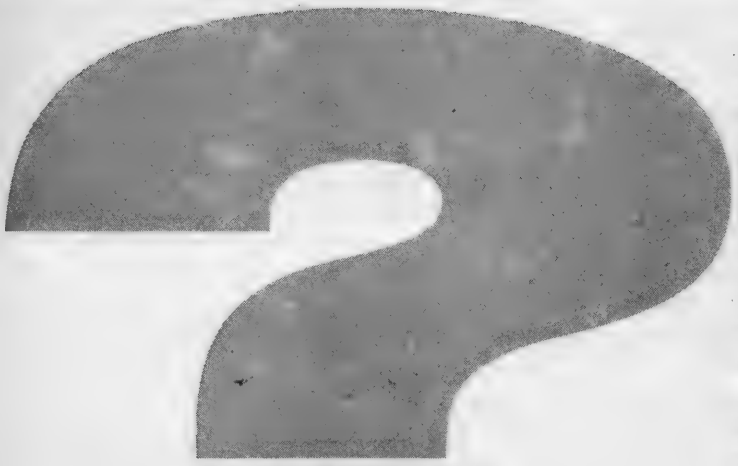

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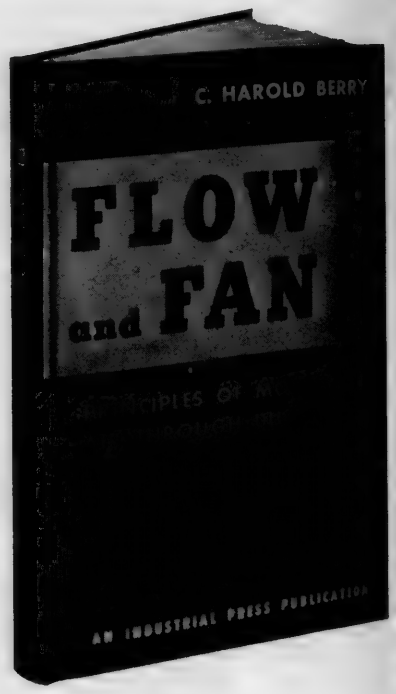

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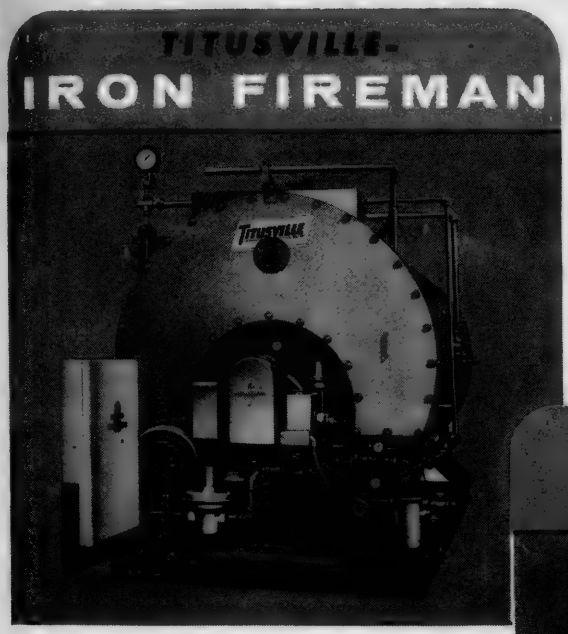

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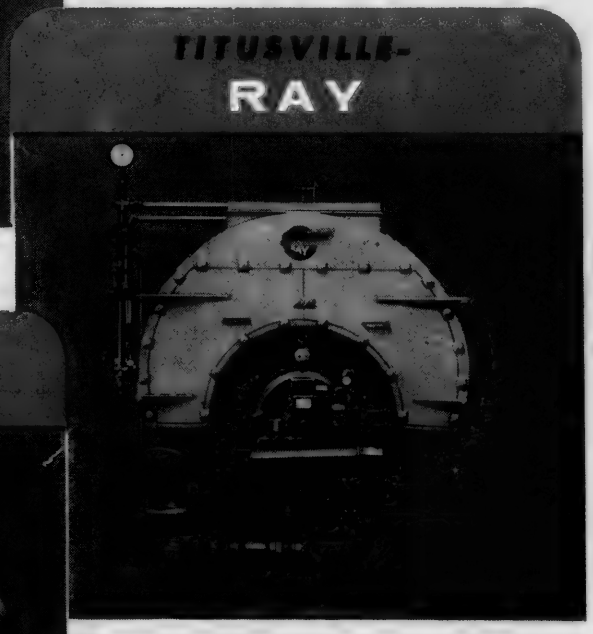

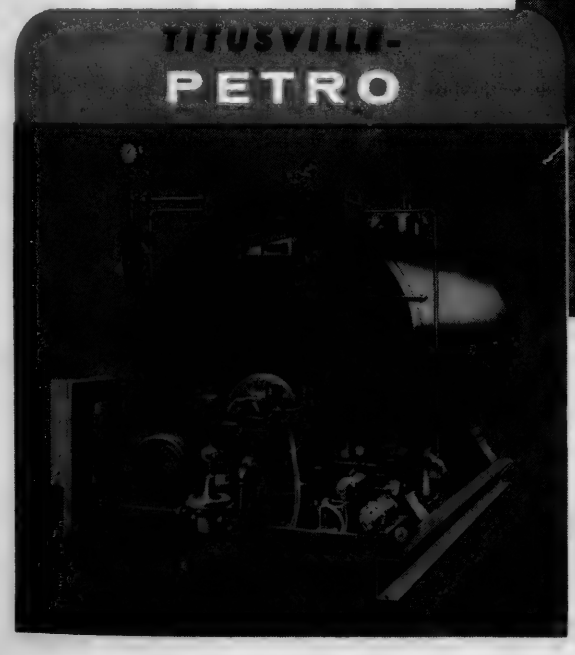

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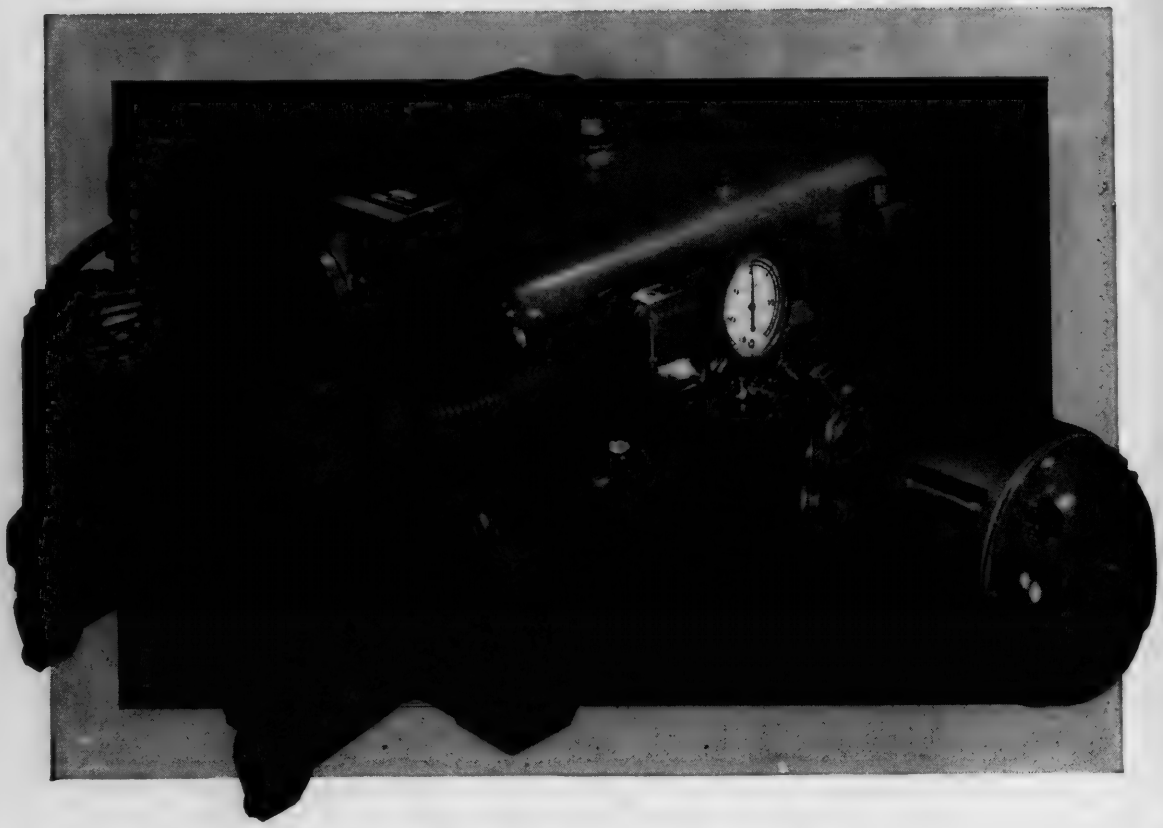

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Capacity Control for Compressors

Fig. 1. The refrigeration cycle.

W. G. WASSMANDORF

Refrigeration Sales Department, The Trane Co., La Crosse, Wis.

Various systems have been tried to vary the capacity of reciprocating compressors to suit operating conditions. These systems are described and data given on limitations and advantages.

REFRIGERATION systems operated by reciprocating compressors have four basic components, the compressor, the condenser, the expansion valve and the evaporator. These are shown in relation to a refrigeration cycle in Fig. 1. Over any prolonged period of time, these components must all be in operational balance both in regard to flow of refrigerant and to absorption and rejection of heat.

The majority of air conditioning and refrigeration systems include a direct expansion type evaporator which is designed to handle only the amount of refrigerant actually demanded by the load on the system. This refrigerant is metered into the evaporator by an expansion valve in just the right amount so all liquid will be converted to vapor before the refrigerant reaches the suction end of the evaporator. The direct expansion type evaporator is commonly used to cool water or air, but in either case the same conditions will affect the operation of the entire refrigeration system.

The capacity of the direct expansion coil used to cool air depends upon the quantity of air being passed through the coil, the dry and wet bulb temperatures of this air and the evaporating temperature of the refrigerant. If the quantity of air handled is increased, or if the temperature difference between the air and the refrigerant is increased, the coil will have greater capacity. Because of this increased capacity, the coil will be able to evaporate a greater quantity of refrigerant in a given time. Conversely, a reduction in air quantity or temperature difference between air and refrigerant results in reduced coil capacity with the rate of refrigerant evaporation reduced. If the compressor is operating at a constant speed, any increase in the rate of evaporation will, because of the additional vapor created, raise the suction pressure. Any decrease in the rate of evaporation will result in a lower suction pressure.

From any compressor capacity tables, it is found that as the suction pressure, or temperature, increases, the capacity of the compressor rises due to the increased density of the vapor which makes it possible to pump a greater weight of refrigerant with each piston stroke. Conversely, as the suction pressure decreases, the capacity of the compressor decreases.

In this system, therefore, identical conditions affect the evaporator and the compressor very differently. When the capacity of the coil is increasing, the capacity of the compressor is decreasing. When the capacity of the coil is decreasing, the capacity of the compressor is increasing. Since the coil controls the system capacity, the compressor will respond to condition changes by raising or lowering the suction pressure until a balance is obtained. The compressor and coil must balance at a point where each has exactly the same capacity.

If the load on an air conditioning system falls low enough, the suction temperature can drop below 32F before the balance point is reached. A point will eventually be reached where the moisture condensed from the air will freeze on the evaporator and a layer of ice will be formed. This ice will restrict the air flow, reduce the heat transfer capacity of the evaporator, and the suction temperature will drop even lower. Obviously, some means is required to reduce the capacity of the compressor under

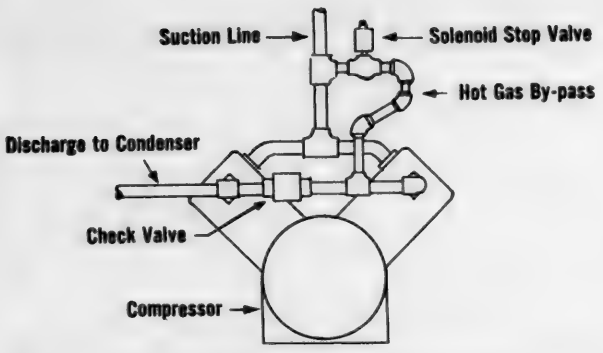

Fig. 2. An early method to reduce capacity, showing the piping for the hot gas bypass.

partial load conditions to raise the suction temperature to prevent this formation of ice.

Low Pressure Switch

The simplest compressor capacity control is the low pressure switch which has its pressure connection in the compressor suction manifold and its electrical contacts wired in series with the holding coil of the compressor starter. When the suction pressure drops below a preset limit, the switch opens, breaking the electrical circuit through the compressor starter holding coil, and stopping the compressor. When the suction pressure rises, the switch closes, energizing the motor starter and again starting the compressor.

This method of compressor capacity control is seldom satisfactory since partial loads will cause the compressor to short-cycle (stop and start frequently) and will impose undesirable stress on the electrical equipment. If too frequently started, the motor may overheat and the contacts in the starter suffer. The starting current thrown on and off the line may cause power fluctuation particularly for application where large motors and compressors are involved.

Multi-speed Motors

The capacity of a reciprocating refrigeration compressor is proportional to the compressor speed and multi-speed motors can be used to vary the capacity. The motor can be controlled with a manual speed changing switch and constant speed motor starter, so arranged that the starter stops and starts the compressor at a single speed. However, manual control is unsatisfactory in most systems where variations in load during the day would require constant attention from an operator to vary the compressor speed with the load variations.

A two-speed motor can be operated automatically by employing two low pressure switches and a two-speed magnetic starter. Thus, at a high suction pressure, indicating a heavy load, the compressor operates at high speed. As the load decreases and the suction pressure falls, one of the pressure switches operates to switch the compressor from high to low speed. If the load continues to decrease and the suction pressure falls low enough, the second low pressure switch operates to stop the compressor. Although this method is automatic and effective, it is extremely costly and therefore it is not too frequently used.

Hot Gas By-pass

One of the early methods used to reduce capacity, without reduction in compressor speed, is the hot gas by-pass in which part of the gas discharged by the compressor is returned to the suction side of the machine. Figure 2 illustrates how the piping is run for this operation.

When full capacity operation is desired, the solenoid stop valve in the by-pass line is closed and all the discharge gas passes on to the condenser. When half capacity is desired, the solenoid stop valve is opened and the gas discharged by one bank of cylinders is carried by the hot gas by-pass to the suction line. The check valve prevents the gas from the other bank of cylinders from being carried to the suction line.

The hot gas by-pass is not altogether satisfactory because there is no appreciable reduction in power at reduced capacity. In addition, the hot gas returned to the compressor causes extremely hot cylinder heads if operation at reduced capacity must be continued for long periods, plus lubrication problems and noise.

Cylinder Cut-off Method

Another early but less frequently encountered method of compressor capacity is the cylinder cut-off method illustrated in Fig. 3. A solenoid stop valve is used to close the suction line to one bank of cylinders so no gas can be pumped by them. This is poor practice since the valves of the cylinders, to which the flow of gas is stopped, are permitted to operate. A relatively high vacuum is created in these cylinders and in the manifold behind the stop valve. This vacuum encourages oil pumping and may cause serious trouble. This method is also quite noisy.

Multiple Compressors

Capacity modulation can also be obtained by installing two or more small compressors instead of one large one. Under partial load conditions, only the number of compressors are operated as required by the load on the system.

This method is costly, both from the standpoint of compressor cost and additional refrigeration piping involved. It also creates oil problems but does have the advantage of providing standby service in the event of failure of one compressor.

Cylinder Unloaders

One of the most satisfactory systems of capacity con-

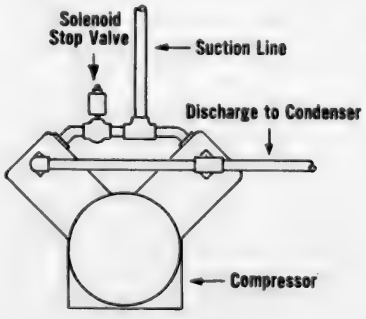

Fig. 3. Cylinder cut-off method. Not used very frequently.

trol is one that employs cylinder unloaders. With this arrangement some method is provided that will hold open the suction valves of some of the cylinders.

With the suction valves held open, the piston will draw gas from the suction manifold on the down stroke, but will return this gas on the upstroke without compressing it, through the suction valves back to the suction line.

In single step unloader systems, it is customary to unload one half of the cylinders. In multi-step unloaders, the machines are unloaded in increments depending upon the number of cylinders in the compressor. With cylinder unloading, the power requirements are decreased almost in direct proportion to the reduction in load.

Compressors with feather valves located in the cylinder heads are unloaded by having the suction valves depressed slightly by metal fingers which are part of the unloader mechanism also located in the cylinder head. These metal fingers may be operated by vapor from the high pressure side of the refrigerant system and hold the suction valves open when partial capacity of the compressor is required. This design requires a pressure switch or a solenoid stop valve for each step of unloading desired.

Compressors having ring plate valves can have their cylinders unloaded by having the suction valve raised from its seat by springs. The action of the springs is usually controlled by oil pressure from the oil pump located in the compressor crankcase.

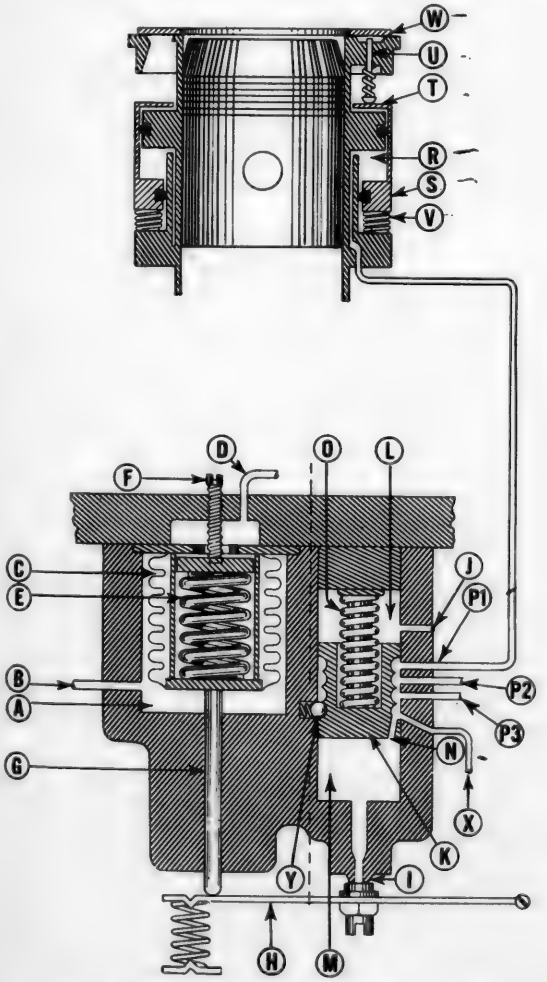

Fig. 4. Section of a modern cylinder unloader.

W. G. Wassmandorf received his mechanical engineering degree from the University of Michigan. He associated with Trane after spending a number of years as a sales representative for Brunner Manufacturing Company and as a sales engineer for General Electric Company. For recreation he turns to golf or bridge.

One of the most modern designs of cylinder unloader mechanisms is shown in Figs. 4 and 5. To understand the complete operational cycle, the mechanism should be considered as being two distinct components: (1) capacity control actuator—one for each compressor. See top parts of Figs. 4 and 5; (2) cylinder unloader mechanism—one for each controlled cylinder—lower parts of Figs. 4 and 5.

Capacity Control Actuator

The capacity control actuator reacts to variations in refrigeration load requirements and transmits them to the cylinder unloader mechanisms which act to load and unload the compressor cylinders. To perform this dual function, the capacity control actuator consists of: (1) A pressure sensing device (Figs. 4 and 5, lower left) which is sensitive to variation in suction pressure; (2) a valving mechanism (Figs. 4 and 5, lower right) which regulates the oil pressure to the various cylinder unloader mechanisms.

Pressure Sensing Device

The pressure sensing device consists of a chamber *A*, connected to suction pressure through line *B*, and a bellows *C* the inside of which is connected to atmospheric pressure through vent *D*. The tendency of the pressure sensing device is to maintain as nearly as possible a predetermined suction pressure. Suction pressure is balanced against a combination of atmospheric pressure and force from spring *E*. The amount of tension is adjustable by set screw *F*. When the system requires less than full refrigeration load, the suction pressure will fall below the predetermined point, causing an unbalance within the device, and the unloading cycle will commence. The drop in suction pressure permits bellows *C* to expand forcing plunger *G* against lever *H* moving it downward. The downward movement of this lever opens the regulated orifice *I* as shown in Fig. 5. The opening and closing of this orifice controls the action of the valving mechanism.

Valving Mechanism

The function of the valving mechanism is to supply each of the cylinder unloaders with oil under pump pressure when full compressor capacity is required and to relieve this pressure when cylinders are to operate unloaded. This valving mechanism consists of a hydraulic cylinder containing an annularly grooved, floating piston *K*. The annular grooves are connected to oil pump pressure through line *X*.

Above the piston is a chamber *L* which is vented to the crankcase through orifice *J*. Below the piston is another chamber *M* connected to the annular grooves in the piston by orifice *N* and connected to crankcase pressure through regulated orifice *I*. Located within the hydraulic cylinder is a spring *O* which tends to move the floating piston toward the lower chamber.

Under full capacity operation, as shown in Fig. 4, regulated orifice *I* is shut off; oil pressure in lower chamber *M* increases because oil under pump pressure is being supplied through line *X*. This pressure overcomes the force of spring *O* and floating piston *K* rises in the cylinder. As it rises, the annular grooves in the floating piston coincide in sequence with lines *P1*, *P2* and *P3* to the cylinder unloaders providing them with full oil pressure and permitting them to operate at full capacity. To make Figs. 4 and 5 as simple as possible, only line *P1* is connected to a cylinder unloader mechanism. Lines *P2* and *P3* are in reality connected to identical mechanisms in two other cylinders and while this discussion is concerned with only one unloader mechanism, it can be extended to cover them all.

When full compressor capacity is not required, regulated orifice *I* is opened through movement of lever *H*; oil bleeds through it and pressure within the lower chamber approaches crankcase pressure, as shown in Fig. 5. Under these circumstances, the force of spring *O* overcomes the pressure in the lower chamber and floating piston *K* is moved downward so that lines *P1*, *P2* and *P3* become connected in sequence to crankcase pressure through orifice *J*. The spring loaded ball *Y* permits the piston to move only in distinct increments, one groove at a time.

In this manner, the valving mechanism supplies or withdraws from each cylinder unloader the oil pressure that operates the unloader mechanism.

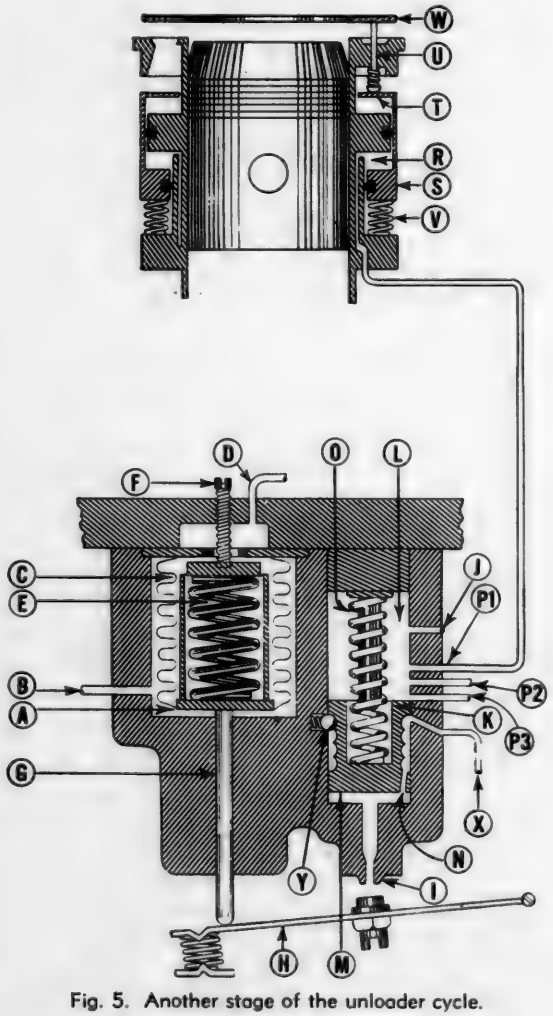

Fig. 5. Another stage of the unloader cycle.

The Unloader Mechanism

When oil from the forced feed lubricating system flows through line *P1*, from the valving mechanism to the cylinder unloader, it enters annular chamber *R*. The inner wall or unloader cylinder is firmly anchored to the cylinder liner; the unloader piston *S*, however, is free to move. The up and down movement of this unloader piston raises and lowers take-up ring *T* which raises and lowers suction valve lift pins *U*.

Under full capacity operation (Fig. 4) oil flows into annular chamber *R* under pressure sufficient to contract the unloader piston springs *V*. When oil pressure forces springs to contract, the unloader piston *S* moves down and take-up ring *T* and the suction valve lift pins *U* move with it. This permits the suction valve *W* to function normally and the cylinder operates at full capacity. When the compressor is to operate at less than full capacity (Fig. 5) oil line *P1* from the cylinder unloader mechanism is connected to crankcase pressure through orifice *J* which allows the pressure in the annular chamber *R* to dissipate; the cylinder unloader springs *V* expand, lifting the unloader piston *S*. This raises the take-up ring *T*, the valve lift pins *U* and holds the suction valve *W* open so that the controlled cylinder is operating in an unloaded condition.

Maximum Control Flexibility

This compressor unloader is sensitive to variations in suction pressure. If it is desirable to unload the compressor in response to variations in air or water temperature, this can be accomplished also through the use of pneumatic or electric controls. By introducing controlled air pressure, from a pneumatic thermostat, to the inside of bellows *C* in place of normal atmospheric pressure, the suction pressure at which unloading begins can be varied, thus making compressor operation responsive to variations in air or water temperature as sensed by the pneumatic thermostat. When electric control of unloading is desired, screw *F* is replaced by a mechanical device. It resets the suction pressure at which unloading begins by compressing the spring *E*. This device is driven by an electric motor that is positioned by an electric thermostat.

This design of cylinder unloader mechanism best answers the requirements of air conditioning systems since it (1) provides unloaded compressor starting, (2) results in reduced brake horsepower in proportion to load, (3) is completely automatic in operation, (4) provides maximum capacity range and flexibility and (5) is noiseless in operation. It is the compressor designer's most recent answer to the problem of balancing compressor capacity with load requirements.

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Heating and Air Conditioning Systems Can Be Served by

Lubricated Plug Valves

H. A. ALORFER

Chief Engineer, Central Valve Research and Development Department, Rockwell Manufacturing Company

Data regarding the design, use and maintenance of lubricating plug valves for service in heating and air conditioning systems.

As compared with the chemical, refining and processing fields, valve service requirements for heating and air conditioning systems are relatively simple. Temperatures and pressures are reasonable and the fluids handled are not particularly corrosive.

For satisfactory performance, a valve should be simply constructed, quick and easy to operate, provide tight closure, and should have a long service life with a minimum of maintenance. Engineers will find that the lubricated plug valve covering design and service meets these specifications.

Through long identification with the petroleum, gas and chemical industries, the lubricated plug valve has acquired a reputation of being a precision-engineered unit for special duty applications. Yet, they are not out of line cost-wise with the more conventional gate and globe valves for the same class of applications.

Service for Valves

Both the plug and the gate valve are of the "block" or complete shut-off type, as compared with the globe valve which is used primarily for throttling service. Gate valves can be used for throttling but will not give tight shut-off after they have been used for such service. Plug valves, on the other hand, are often used for throttling where accurate adjustment is not necessary. For both types, the primary service is positive open-close operation.

Fig. 1. Lubricated plug valves used on a low pressure steam heating system.

In the form of the common stop-cock, the tapered plug valve is probably one of the oldest devices used by man for the control of fluids in closed conduits. In fact, an ancient Pompeian bronze stop-cock known to be nearly 1,900 years old is remarkably close to present-day stop-cock design. However, it was not until the pressure-lubrication principle was introduced around 1916 that the plug valve became available in a range of sizes, styles and materials for wide application.

Design and Construction

There are only three basic parts comprising the plug-type lubricated valve—(1) body, (2) cover, and (3) plug—the plug being the only movable member.

While the plug is available both in cylindrical and tapered form, the latter is generally preferable. Nothing is simpler for valve actuation than the tapered rotary principle. Since the valve is opened and closed by rotation only, and not by raising and lowering the movable valve member, vital seating surfaces are self-protecting and self-cleaning. The valve does not contain enlarged pockets or recesses to collect sediment, scale deposits or other foreign bodies to interfere with valve action.

The tapered shape of the plug combines the tight fit advantages of wedge action with the sliding action of rotary movement. Properly lapped, the plug is self-seating and is self-adjusting for wear.

A lubricated ground joint type of shoulder is used in preference to conventional stuffing boxes which operate by gripping around a stem or rod. The shoulder joint is compact, produces a minimum of friction, and combines the functions of stem seal and thrust bearing.

Thrust and Seal

Application of the shoulder seal principle is the same for the various standard types, that is 2-bolt cover, which combines cover and gland in one piece, screwed gland and bolted gland. In all three types, thrust against the upper shoulder of the tapered plug is transmitted through a resilient cushion packing and a sealing diaphragm gasket. The sealing member is a thin flexible metal diaphragm of anti-friction and corrosion-resistant material.

The diaphragm assembly is clamped firmly together and does not rotate. As the valve is turned between open and closed positions, the ground surface at the top of the plug slides freely against the metal diaphragm. Leakage is prevented by the lubricated close fit betwen the two parts and the relatively narrow area of contact through which the plug-sealing thrust is applied.

Quick Opening and Closing

One of the outstanding features of the plug valve is its quick opening and closing operation. A quarter-turn fully opens or closes the valve. A stop collar on the valve gives positive indication as to the position for open or close. In this way, the operator does not have to rely on the feel of a wheel's resistance to tell if the valve is closed.

The 2-bolt cover type valve has a square wrench head on the plug stem and a stop-and-indicating collar which also serves as a weather shield for the stem clearance

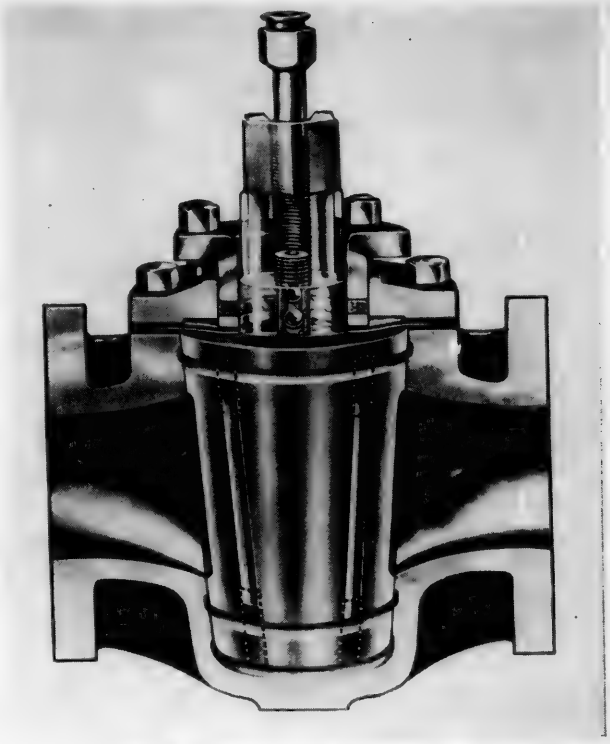


Fig. 2. Cross section of a plug valve.

space. Other types have a wrench flat or a wrench square plug shank, with a stop collar on the shank and engaging lugs on the cover or on the shank and gland.

Compared with valve body designs for other types of open-close valves, the lubricated plug valve body is probably the simplest and most compact. There are no high projecting yokes or bonnets, no exposed threads and no underhanging body to require room below the pipe line. In most cases, the space occupied by the lubricated plug valve is a little more than the diameter of the pipe line flanges.

The space economy offered by this type of valve makes it particularly suitable for manifolds for pump houses, under pavements or other places where space is at a premium.

Because the valve does not require large bonnet and body cavities, there is a substantial weight saving. In addition, top-heavy, cumbersome flanges, normally required to support the stress of wedge action above the valve, are not required for the sliding action of the tapered plug.

Plastic Sealing and Lubrication

As mentioned earlier, it was the development of the pressure-lubrication principle that gave impetus to widespread application of the plug valve. Pressure lubrication performs three important functions, (1) provides jacking action, (2) seals the valve and (3) reduces friction and wear to a minimum.

Lubricant pressure exerts powerful jacking action against the smaller end of the valve plug, momentarily unseating it. This action overcomes any adhesion and, because of the taper, creates a small space for a confined lubricant film between the plug and body. As a result,

Fig. 3. Large valves used on low pressure steam lines; small valves on gas supply line.

regardless of how long a period a valve is not opened, there is a positive means of unseating the valve, without having to use a hammer or wrench. Further, the jacking not only puts the valve into operation after long dis-use, but provides lubrication at the same time.

Spring action is provided in the valve without the need for complex spring design, by the resiliency of the shoulder seal packing.

The usual means of exerting lubricant pressure is an elongated screw, threaded into the outer end of the plug shank. Because of its smaller diameter and the use of a fine-pitched thread, the lubricant screw develops ample pressure on the lubricant, yet turns freely. These screws are often provided drilled and fitted with a giant button head fitting for grease gun lubrication.

Lubricant is distributed around the plug and valve body by means of lubricant grooves, divided between the body and plug. The grooves are so located that when the valve is in the closed position, valve ports are completely sealed by a lubricant film between the ground seating surfaces.

Thorough lubrication of the plug and interior surfaces of the valve body makes for easier valve operation and long life. The plug does not require excessive torque, since pressure thrust is carrried on a large lubricated bearing area, instead of on a narrow dry seat as in ordinary valves. Unless destructively treated, breakage of a plug valve shank is practically unknown.

Application

For general service lines such as hot and cold water, compressed air, gas, low pressure steam, fuel oil, refrigerant, fire protection and so forth standard semi-steel plug valves are used. Plug valves are available in patterns interchangeable with standard gate valves. The valves are also produced in wide variety of metals and alloys for special services involving corrosion, high or extreme low temperature, pressure or other special operating conditions.

The valves are available equipped with every type of standard or special flanges, including Dresser ends. For jacketed service, plug type valves are available with complete flange-to-flange jacketing in standard sizes.

Plug valve accessories are available in a wide variety of forms to allow complete flexibility in method of installation, operation and servicing. Wrenches for hand operated valves include lever, chain, socket and offset types; standard electric and pneumatic motor operated units are also available. Valve extensions include turning stem-extensions for wrench handle operation, worm gear shaft extensions, watertight gear housing of the road box and sealed top design with indicator types, floor stand plant extensions and elevated gear or cylinders.

The proper lubricant can be selected for a specific application from standard off-the-shelf stocks, packed in tubes that will fit any size valve. Lubricating equipment includes lubricant screw, external lubricator, hand and bucket guns, air power gun and button head fittings.

Maintenance

A recent survey of our sales of plug type lubricated valves extending back over a 20-year period indicated that the ratio of repair and replacement parts is less than 1 to 100. Put another way, lubricated plug valve repair parts over a period of years are about a tenth of the cost of other type valves. This favorable differential is due to the fact that there is little or no need for renewal of seating parts, packings, stems or re-welds.

A simple program of periodic lubrication, which takes a minimum of time will keep lubricated plug valves in service for the life of the piping. In fact, we have come across numerous cases where plug valves have been taken from old, worn lines and re-installed on new piping.

Because of the tapered plug and lubricant sealed design of these valves, they are not restricted to one-way flow. The valve can be installed in either direction because it holds pressure in either direction. Flow can be reversed any time without the danger of leakage or jamming.

This feature means a constantly renewable valve seat. Instead of expensive repairs on seat and closing members, simple lubrication renews the sealing surfaces without necessity of dismantling the valve—or even removing it from the line.

A common hazard to the life of valve seats is the abrasion caused by dust, dirt and debris in the line. This hazard is entirely eliminated in the lubricated plug valve if proper gland adjustment is maintained. Critical seat areas are fully lubricant sealed, and the lubricant is under pressure so that abrasive material cannot intrude. Any dirt or scoring material that may reach the plug is scraped off when the plug is turned back to open position.

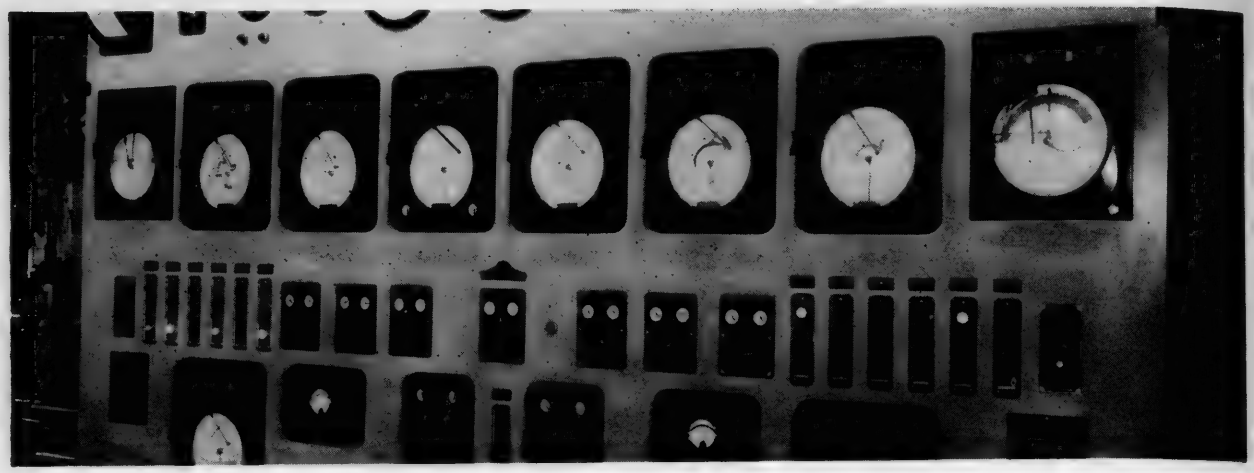
Regardless of the line pressure, the plug valve can be relubricated as effectively as with no pressure. Lubricant injection builds hydraulic pressure within the valve to the required degree. In this way the plug can always be effectively lubricated and the jacking chamber under the plug adequately pressurized to permit easy turning. As a result, even if a plug type lubricated valve is not opened for extended periods of time, it can be easily opened, without difficulties of galling or freezing.

(Above) Constructing the huge Grant Park underground garage which extends three blocks under Michigan Avenue, Chicago, and under most of the west portion of the park. Shown is early construction of the two-level 2,359-car garage. Precast concrete slabs were used for the 131,000 sq ft suspended ceiling.

Underground Garage

(Right) T-irons were bolted to hangers suspended from the poured concrete garage roof to support the precast concrete slabs for a suspended ceiling so as to provide a plenum chamber 42 inches deep. Through this chamber fresh air is supplied for ventilating the garage. Slabs measure 2 by 5 ft and are 1⅝-inch thick.

(Right) This suspended ceiling encloses the plenum chamber which supplies air for ventilation. Space that was left between slabs was sealed with asphalt asbestos mastic, and then the entire under surface of the slab was painted white. Special slabs provide for the recessed lighting fixtures. Air is exhausted through grilles on the west wall. Fifteen complete air changes per minute are provided by 28 tubeaxial fans ranging from 20 to 30 hp. Ralph H. Burke, Inc., and John Griffith and Son Construction Company, both of Chicago, were designers and general contractors, respectively.



Boiler House Instrumentation and Boiler Efficiency

ALMONT H. KOEPF
Boeing Airplane Co., Seattle, Wash.

Much costly time is spent on design, installation, and use of boiler house instrumentation. Large plants are usually well designed in this respect but quite frequently medium and small plants are inadequately or improperly instrumented. The Boeing Airplane Co. leases or owns a number of facilities with gross generating capacities up to 120,000 pounds of steam per hour. These plants run with instrumentation ranging from a single steam pressure gage to extensive panels of instruments. Experience has led to a critical evaluation of the ability of each instrument to provide acceptable results without loading a design. An example of combustion analysis is given.

THE purposes of instrumentation, basically, are two: First, every pressure gage, thermometer, draft gage, CO_2 meter and flow meter, is a boiler house assistant, whose job it is to help the operator find trouble or spot items for preventive maintenance. Second, instruments report performance of the boiler plant, and can be used as guides to maintaining optimum generating cost. Instrumentation will allow maximum boiler output without gambling on damage to equipment. This is quite important in periods of occasional peak loads.

The size of the boiler house and end uses of the steam will dictate the degree of instrumentation. In large installations, a tenth of a percent efficiency waste can mean thousands of dollars annually. Medium plants generally require instrumentation that will allow control to one per cent; while small plants need only five per cent regulation. Cost of instrumentation is weighed against the control savings. For convenience a breakdown of instrumentation for medium and small plants is discussed.

Medium Boiler Plants

Pressure gages are necessary for trouble shooting reading of steam header pressure, feed water discharge pressure, feed water suction or deaerator pressure, oil suction vacuum, oil discharge or burner pressure, atomizing steam pressure, auxiliary steam pressure, condensate pressure or vacuum, water, air and gas pressure. Size gage faces large enough to be seen from normal observation positions. Use compound pressure and vacuum gages where the possibility of going both ways exists, and use ranges considerably higher than the maximum possible to protect the calibration. Conventional practice seems to dictate that the normal working point is in the center of the scale so the indicating needle is practically vertical.

Draft gages should be connected on the upstream side of all dampers, that is forced draft or induced draft, so the operator can tell if his combustion air is moving properly. Use draft gages that are easy to view and calibrate. Thermometers have the dual job of trouble shooting and heat balance indication. Readily readable indicating thermometers should be installed to show steam (only it superheated), feed water, oil suction, burner oil, condensate return, cooling or hot water and stack gas temperatures.

If the stack gas temperature is combined with a CO_2 meter, a continuous check of boiler efficiency is readily obtained. The development of the efficiency is a joint analysis of flue gas and stack heat loss. This is described under the heading, *Combustion Efficiency*. For this reason the stack temperature and CO_2 should be recorded to provide a permanent history of boiler performance. Since CO_2 meters are quite expensive and generally record relatively constant values, a single CO_2 meter can be made to do the recording of many boilers. Simply install

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solenoids in the flue gas lines to the analyzer in parallel with indicator lights above the meter. Use either a selector switch or automatic timer system. It is not normally necessary but a boiler number printer can be installed on the CO_2 recording chart.

Flow meters are the nerve centers of the mass flow system, and give the necessary record of oil consumption, steam produced, and makeup water. When combined with temperature, pressures and heat content of the fuel, they assist in developing a plant heat balance. All flow meters must be integrating to provide a continuous gross record of flow. The steam meter should be recording also, to furnish a picture of consumption and plant utilization. As one look is generally all the charts receive before being placed in storage, we use the less expensive square root mechanical meters for steam, and the displacement meters for oil and water. The operator will occasionally experience difficulties with oil flow meters, particularly with the heavier grades. He should check the oil meters periodically by sticking the tanks.

To position the instruments, choose a convenient location where the operator can view them from the firing aisle. A small panelboard dresses up the boiler house very nicely.

Small Boiler Plants

Trouble shooting pressure gages are highly useful in small boiler plants to indicate steam pressure, oil pressure or suction, feed water pressure, condensate pressure or vacuum, and water, air, and gas pressures. Naturally, gages will be small and need not be as expensive as for larger plants. Since most installations are packaged units, no draft gages are required. Draft settings are generally fixed or linkage controlled by fuel flow, and periodic check is all that is necessary. Thermometers should be included for feed water, condensate, oil, hot water and stack gas temperatures. No CO_2 meter is justified but a 5/16-inch hole should be left in the stack adjacent to the boiler to provide access for an inexpensive combustion test set consisting of a CO_2 tester and draft gage to combine with the stack gas temperature. Spot checks will insure continuous good boiler performance at low cost, and the stack temperature will indicate interim performance between spot checks. Flow meters must be considered from a strictly dollar angle. Oil meters are recommended to provide a continuous record of consumption. Circumstances and resultant economic analysis will dictate the justification for a steam flow meter or water meter.

The final and most important instrument is the operator himself, since he is the one to read and interpret the gages and meters. Give him a good functional log sheet requiring only the most important information, and police it by showing him the value of each reading. Let him calculate current boiler efficiency for his own satisfaction from a simple chart such as Table 1. Fig. 1 shows a skeleton schematic flow diagram of a typical oil fired boiler plant indicating recommended instrumentation.

Combustion Efficiency

Combustion efficiency is more properly evaluated when the stack loss is used. The equation for efficiency is written as

$$e = 100\left(1 - \frac{\text{Stack Loss per lb Fuel}}{\text{Heat Content per lb Fuel}}\right)$$

The stack loss is a combination of dry flue gas heat and water vapor as

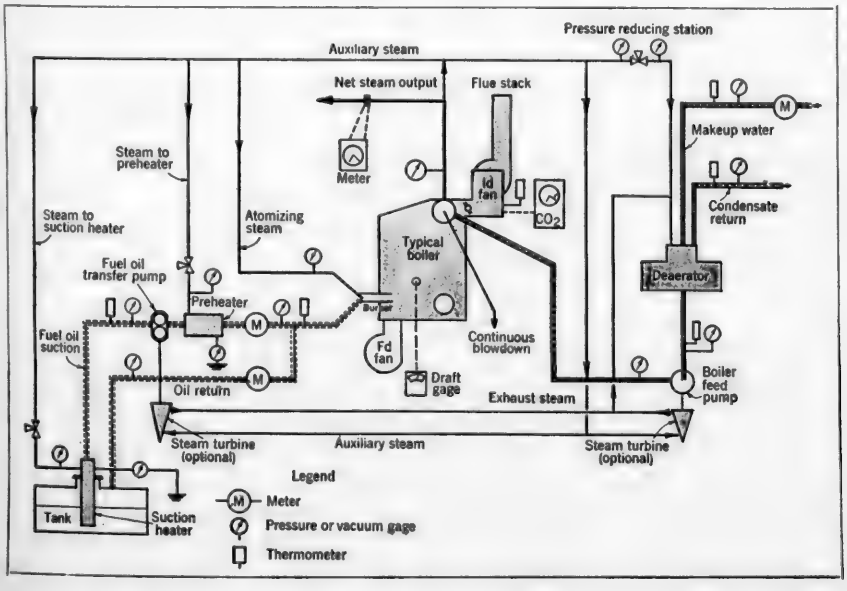

Fig. 1. Schematic flow diagram of typical oil fired boiler.

TABLE 1—BOILER EFFICIENCY CHART

Stack Temp. F.	Percent CO_2 in Flue Gas								
	6	8	10	11	12	13	14	15	16
	Boiler Efficiency								
250	80.8	82.4	83.8	84.4	84.6	85.0	85.2	85.4	85.6
300	78.6	81.0	82.4	83.0	83.4	83.8	84.0	84.4	84.6
350	76.2	79.0	81.0	81.6	82.2	82.6	83.0	83.4	83.6
400	73.8	77.2	79.4	80.2	80.8	81.4	82.0	82.4	82.6
450	71.4	75.4	78.0	78.8	79.6	80.2	80.8	81.2	81.6
500	69.2	73.6	76.4	77.4	78.2	79.0	79.6	80.2	80.6
550	66.8	71.8	75.0	76.0	77.0	77.8	78.4	79.2	79.6
600	64.4	69.8	73.4	74.6	75.6	76.6	77.4	78.0	78.6
650	61.8	68.0	72.0	73.2	74.4	75.4	76.2	77.0	77.6
700	59.6	66.2	70.4	72.0	73.2	74.2	75.2	76.0	76.6
750	57.2	64.2	68.8	70.4	71.6	72.8	73.8	74.8	75.6
800	54.6	62.4	67.2	69.0	70.4	71.6	72.8	73.8	74.6
850	52.2	60.4	65.8	67.4	69.0	70.4	71.6	72.6	73.6
900	49.0	58.4	64.0	66.0	67.8	69.2	70.4	71.8	72.6

ASSUMPTIONS:
Entering air 75°F
SO_2 included with CO_2
Radiation, etc., loss 5%
Heat content 18,730 Btu per lb

FUEL OIL ANALYSIS
Carbon 87.0%
Hydrogen 11.0%
Sulphur 1.5%
Variables 0.5%

$$H = W_g C_p (T_g - T_a) + W_w [1089 + 0.46 (T_g - T_a)]$$

where H = heat loss, Btu per lb fuel
W_g = weight of dry flue gas, lb per lb fuel
C_p = specific heat of flue gas = 0.24 Btu (per lb) (F)
T_g = temperature of flue gas, F
T_a = ambient inlet temperature of air, F
W_w = weight of moisture, lb per lb fuel

The flue gas weight is difficult and impractical to measure directly. In its place the flue gas is sampled and the per cent CO_2 taken from a dry gas analysis. There are, of course, many charts and curves available to determine the relationship between percent CO_2 and hence excess air (representing mass flow) and stack temperature (representing stack heat loss) to determine efficiency. Table 1 is a typical chart. The analysis behind these charts begins with the chemical combustion equations. The combined ultimate resulting equation is used to find oxygen for perfect combustion and, by corrections for nitrogen, (23.2% O_2 and 76.8% N_2 by weight) the air for perfect combustion. This gives the total flue gas weight. Converting weight to dry flue gas volumes the percent CO_2 can be readily developed.

A numerical example can best illustrate the analysis. Consider the typical heavy fuel oil with the following properties.

Analysis	0.87 carbon, 0.11 hydrogen, 0.015 sulphur, 0.005 variables
Heat Content	18730 Btu per lb
Entering Air Temperature	75F
Stack Temperature	600F
Percent CO_2	11.0
Atomic Weights	carbon 12, hydrogen 1, sulphur 32, oxygen 16

The molecular equations are:

$$C + O_2 \rightarrow CO_2$$
$$(0.87)C + 32/12(0.87)O_2 \rightarrow 44/12(0.87)CO_2$$
$$H_2 + \tfrac{1}{2}O_2 \rightarrow H_2O$$
$$(0.11)H_2 + 16/2(0.11)O_2 \rightarrow 18/2(0.11)H_2O$$
$$S + O_2 \rightarrow SO_2$$
$$(0.015)S + 32/32(0.015)O_2 \rightarrow 64/32(0.015)SO_2$$

The combined ultimate equation is

$$(1.00)\text{fuel} + (3.21)O_2 \rightarrow (3.19)CO_2 + (0.99)H_2O + (0.030)SO_2$$

Using air with oxygen at 23% by weight,

$$(1.00)\text{fuel} + (13.93)\text{Air} \rightarrow (3.19)CO_2 + (0.99)H_2O + (0.03)SO_2 + (10.72)N_2$$

The dry flue gas contains, per pound of fuel,

$$(3.19\text{ lb})CO_2 + (0.03\text{ lb})SO_2 + (10.72\text{ lb})N_2$$

As SO_2 is absorbed with CO_2 a further combination yields 3.22 lb CO_2 and 10.72 lb N_2. Dividing each by the molecular weight would give

$$\frac{3.22}{44} = 0.0732 \text{ pound-mole } CO_2$$

$$\frac{10.72}{28} = 0.383 \text{ pound-mole } N_2$$

Percent CO_2 by volume is measured by $\dfrac{0.0732 \times 100}{0.0732 + 0.383}$

$= 16.1\%$ for perfect combustion.

Naturally, normal firing utilizes some excess air to insure complete combustion, therefore the total equation can be written as

$$(1.00)\text{ Fuel} + (13.93 + x)\text{ Air} \rightarrow (3.19)\ CO_2 + (0.99)\ H_2O + (0.03)\ SO_2 + (0.77\ x + 10.72)\ N_2 + (0.23\ x)\ O_2$$

The dry flue gas contains in pounds per pound of fuel,

$$(3.22)\ CO_2 + (10.68 + 0.77\ x)\ N^2 + (0.23\ x)\ O^2$$

Again converting to pound-moles,

$$\%\ CO_2 = \frac{7.32}{0.4562 + 0.0347\ x}$$

If, in the sample, CO_2 is 11.0%, x = 6.0 lb (or 30.1% excess air). The dry flue gas weight is then 20.93 lb per pound of fuel.

Having flue gas weight the stack loss can be evaluated as $H = 20.93\ (0.24)\ (600 - 75) + 0.99\ [1089 + 0.46\ (600) - 75] = 3820$ Btu per lb fuel.

The efficiency is $e = 100\left(1 - \dfrac{3820}{18730}\right) = 79.6\%$

Subtracting an arbitrary 5% for radiation losses, the net efficiency is 74.6%.

Heat Balance

During the design of a boiler house the complete heat and mass balances must be developed to size piping and auxiliaries. Occasionally the chief operating engineer might wish to check current performance during operation. Having determined the combustion efficiency, with necessary pressures and temperatures of all lines, plus metered steam, makeup feed water, and oil flow provided by instrumentation, the balances can be determined by working from oil flow, through the furnace, to the feedwater and oil heating and finally to net steam generated.

WORK

A Discussion of its Engineering Significance

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HEATING AND VENTILATING'S REFERENCE SECTION

WORK – a Discussion of its Engineering Significance

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ALL practical engineering processes involve the storage, transportation, or transfer of energy. Energy storage occurs in potential form (due to position, as storage in a rock on top of a hill) or in kinetic form (due to velocity, as the energy associated with a high-velocity bullet) or in internal form (as the thermal energy associated with a hot substance or the energy associated with change of state from liquid to vapor or from solid to liquid). Energy transportation occurs as stored energy within the working substance (steam, water, air, or refrigerant) and is carried by the moving working substance from one place to another. Energy in transition ocurs as heat or as work.

1. Heat transfer by the mechanisms of conduction, convection, or radiation is an essential and well understood phenomena.
2. Work, though the most important and most versatile manifestation of energy, is the least understood and least clearly recognized of all the energy forms with which the professional engineer must deal.

Work as a Transient Effect

Work is the most desirable of all energy forms, since a conversion from work to any other energy form proceeds more readily than conversions from other forms to work. (A mixing paddle readily warms the fluid by converting shaft work to internal energy, but it is inconceivable that a hot fluid would spontaneously cool while delivering shaft work to the mixing paddle.)

In the great majority of processes and cycles the end product is shaft work. Thus, in a steam power plant, an internal combustion engine, a thermo-jet, or a gas turbine, the intent of the cycle is to provide a thermal path along which molecular energy stored in chemical form in a fuel will be transformed, in as large a part as is thermally feasible, into shaft work. An additional conversion, as in the generator of a steam or hydro plant, changes shaft work to electricity in order to permit more effective long distance transmission, but the mechanical - electrical conversion occurs outside the usual field that is of mechanical engineering interest.

In one major respect work and heat are similar: Neither their presence, absence, nor cessation influence the state at any point in the working substance. If one were to examine with great care the state of the metal at any point in a copper rod, one could not determine from that examination whether or not a transfer of heat was occurring through the rod. In the same way, careful examination at a point in a propeller shaft would fail to disclose whether or not work was flowing through the shaft. Thus neither work nor heat influence the state of the material through which they are flowing though the addition or removal of either work or heat from any substance (in contrast with flow *through* the substance) does affect the state of the material. This situation is not different from that which exists with tangible materials: The flow of water under steady state conditions through a pipe does not lead to any alteration of conditions within the pipe, whereas the flow of water to or from storage in a tank has a most definite effect on conditions within the tank.

Work as a Force-Distance Product

Irrespective of the form in which it may manifest itself, work is always equivalent to, and expressed as, the action of a force through a distance. Thus *all* expressions applicable to special manifestations of work must come from the one fundamental equation:

$$\text{Work} = \text{Wk} = (\text{F})\,(\text{S}) = \int \text{FdS ft lbs} \qquad (1)$$

where F is a force in pounds, S is a distance, and dS is the infinitesimal distance over which the force acts. The integration of equation 1 obviously requires knowledge of the way in which the force varies as a function of distance. Since the relationship between force and distance is sometimes rather complex, it is evident that integrable forms of equation 1 may be diverse, but it is important to remember that all expressions for energy in transition as work must be some form of this one basic equation.

Perhaps the simplest visualization of work is in the

In all of the processes and cycles of heating, ventilating, air conditioning, and refrigeration, the engineer is seeking to deliver energy to a place where it is needed or to remove energy from a space where it is not desired. The working substance, whether steam, hot water, warm air, or a refrigerant, is no more than a thermal "wheelbarrow" intended to transport the major commodity, energy, from the point of liberation to the place of utilization. Yet, strangely enough, engineers commonly talk, and think, in terms of the particular working substance rather than of the energy which is actually the item of major importance. This is disadvantageous for one vital reason: Energy concepts are independent of either the type of system or the type of working substance. Hence when an engineer thinks in terms of energy, he reaches a degree of generality which permits direct extension of his thinking to all systems and to all working substances. The intent of this reference section is to review and classify the various ways in which energy as work is important to the professional engineer.

action of the force of gravity through the distance that an object is either raised or allowed to fall. The force acting on an accelerating object is equal to the product of mass times acceleration, but since mass is weight divided by acceleration, it follows that the weight of the object is numerically equal to the force which acts on it; thus the weight of any object is equal to the force exerted by gravity on that object. When an object is either raised or lowered, work is either done on or by it, in an amount equal to the product of its weight by the vertical distance of travel. In effect, therefore, the numerical evaluation of external potential energy, wz, is equal to the work which is done on an object of weight, w, in raising it vertically through z feet. Note, therefore, that the product wz is equal both to the work that is done in a process of frictionless lifting (or the energy that is transferred during the process) and the energy that is present in storage within the system after completion of the transitory process. If, instead of being lifted vertically, the object had been pushed up an incline, or if it were lifted vertically by means of a pulley system, the wz product would still represent external potential energy in storage after the increase in elevation, but it would no longer equal the total work done to raise the object, since by either of these latter methods, friction effects would require that more work be done than that going into direct potential storage.

When an object weighing w pounds falls (neglecting air friction), work is done in the amount wz and the energy originally stored in external potential form is transformed, as a result of the transition in the form of work, to energy in external kinetic storage. Thus an object at height z possesses wz foot-pounds of external potential energy and as the object falls, without friction, to the surface of the earth, wz foot-pounds of energy are transferred as work of acceleration, to external kinetic storage.

As a corallary, an object which leaves the surface of the earth with velocity v and is projected vertically upward, does work against the force of gravity (but neglecting air friction) and is finally brought to rest at height z after all of its external kinetic energy has been transformed—

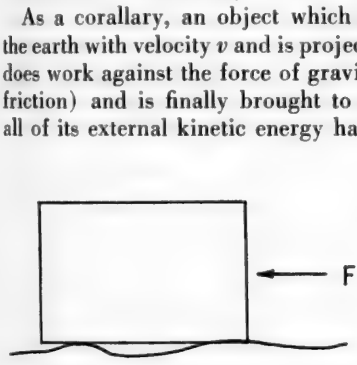


Fig. 1. Force applied directly to object.

in the decelerating work process—to external potential energy.

Shaft Work

A shaft is essentially a conduit through which energy flows as work from the point of origin to the point of dissipation. Referring to Fig. 1, consider an object which will slide across a rough surface only when a force of F pounds is applied to overcome friction. If the force F is applied directly to the object, the work done in causing a movement of L feet amounts to F(L). But consider the case, Fig. 2, in which the force is applied at the end of a rigid rod. The work required to cause a motion of L feet is, as before, F(L), but the fact that force acts through the rod in no way influences the situation or leads to any change in the rod.

The rod does not "store" the work which passes through it; in fact, the energy which is in transit through the rod does not affect either its state or any other physical characteristic. The transit of work through the rod is visual-

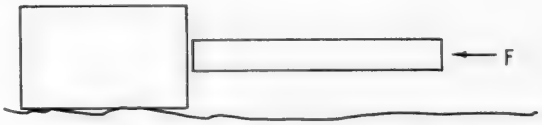


Fig. 2. Force applied at end of rod.

ized as occurring in an infinitesimal time; that is, the instant a force is applied at the right end, it is assumed to be immediately transmitted through the rod and hence becomes active against the object. In every sense, therefore, the work which is transmitted through the rod is recognized as energy in transition. It does not come from storage in the rod, but is supplied from some exterior energy source, as a person, and passes through the rod in much the same way that water flows through a pipe, without at any time or in any way influencing or changing conditions within the rod itself.

Circumferential Force

A second method of transmitting energy through a solid rod is by applying a circumferential force and letting the distance through which that force moves be equal to the distance travelled by a point on the circumference of the rod or shaft as it revolves. Since πd is equal to the length of travel per revolution, it follows that the distance per unit time is πdn where n is the number of revolutions of the shaft in unit time. In this case, the work done at the other end of the shaft will likewise be πdn and this will be entirely independent of the shaft length. Thus, once again, the energy in transit as shaft work flows through the shaft, but does not in any way affect the state of the shaft itself. The rotating shaft, regardless of length, acts merely as a conduit through which the energy is transferred, the rate of transfer being fixed by conditions exterior to the shaft and in no way influencing the state of the shaft itself. The shaft acts merely as a defining path along which the energy flows; energy is at no time stored in the path nor can it properly be said to be within any particular unit volume or unit weight of the shaft; it is merely passing through. Thus in the case illustrated in Fig. 2, the work done in moving the object a distance L would obviously not be dependent on the length, thickness, or density of the rod, but would be determined solely by the weight of the object which was being moved, the frictional resistance to motion, and the distance through which the motion occurred.

Brief examination will show that it would be a relatively simple matter to transform shaft work into either of the forms of energy in storage which have already been considered. Thus if the shaft drove a propeller (as in a blender) submerged in a fluid, the result would be rotational motion (external kinetic energy) of the fluid and eventually under the influence of fluid friction, a rise in fluid temperature in amount proportional to the increase in kinetic internal energy of the fluid. A similar conver-

sion of shaft work to external kinetic energy could be accomplished by attaching paddles to one arm of the shaft and allowing the paddles, while turning rapidly, to impart velocity to small pellets or balls. In all such cases the work passes through the shaft and its passage is in no way influenced by the physical characteristics of the shaft material. Thus the shaft merely provides the path; the amount of energy transferred is determined by external conditions entirely uninfluenced by the state of the material of which the shaft happens to be composed.

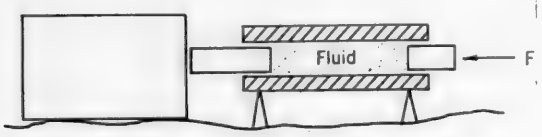


Fig. 3. Force applied to object through fluid.

Flow Work

Reconsidering the situation described in the preceding section, let the rod through which the force was delivered to the object be replaced by a metal tube, Fig. 3, filled with liquid and with a frictionless piston, or long plug, partially inserted in each end. If now the force F is applied to the end of the plug at the right end of the tube, this force will cause the plug to move in, the fluid to move left, the plug at the other end to move out and the object to slide to the left. In every respect, the situation is identical with that shown in Figs. 1 and 2 except that the column of fluid now serves in place of the center section of the rod as a device for transmitting energy as work. The fluid will be no more influenced by the passage of energy through it than was the solid section of rod; its state will remain unchanged and the energy will merely flow through the fluid without altering its physical condition in any possible way.

Since the work delivered through the fluid depends only on the force applied and the distance through which that force acts, it is evident that the result would be the same whether the connecting section of fluid were very thick or very thin, and whether it were long or short. Irrespective of length or thickness of the fluid section, the same amount of energy will be passing every cross section and, in literal fact, exactly the *same* energy will be passing each cross section, since the transfer of work can be visualized as occurring instantly. Hence, the work entering one end is simultaneously leaving the other end.

Returning to the solid rod, Fig. 2: If the force is 10 lb and the distance the object moves is 5 ft, the total work delivered is $10(5) = 50$ ft lb, and this quantity of energy must pass every cross section of the rod. If, now, one chooses to take a position beside the rod and make a mark on the ground and another on the rod to identify its original position, one can say that the work required to move the rod one foot past the mark on the ground is $10(1) = 10$ ft lb. As visualized from the fixed reference position beside the rod, the work associated with each foot of rod length that passes the section in question is 10 ft lb. Such a statement has meaning, however, only when applied to conditions as they exist at the fixed reference point; the work associated with the entire rod is not 10 times its length, but if an infinite number of reference points were set up an infinitesimal distance apart, the work associated with passage of one foot of rod past each reference point would still be 10 ft lb. As the rod moved, the *same* 10 ft lb would pass each cross section in turn; one could not add the energy passing the various cross sections because it would in every case be exactly the same identical energy.

Irrespective of the cross section area of the rod, the force acting at every cross section is necessarily the same, but the stress, S, (force per unit area) is less for larger rod area. If we choose to consider a length, L, of rod (of uniform cross section) such that its weight is 1 pound, then the work transmitted as this length L moves past the mark is:

$$Wk = F(L) = (S)(A)(L) = S\overline{V} \text{ ft lb per lb} \qquad (2)$$

where $\overline{V}$ is the reciprocal of the density, or the specific volume, cu ft per lb.

One could therefore say that $S\overline{V}$ foot pounds of work flow through the rod for each unit weight of rod that is displaced over the mark on the ground, but the total weight of the rod would have work significance only if the total length of rod moved past the mark. The $S\overline{V}$ term does not represent energy stored in unit weight of rod, but merely indicates the energy that would pass through this piece of the rod *if* displacement past the ground mark were to occur.

When dealing with the transmission of work through a fluid, the force applied per unit area of cross section is the pressure, P, rather than the stress and the work which flows through the fluid as unit weight of fluid passes a given cross section of the tube is then $P\overline{V}$ ft lbs per lb. Here again the term $P\overline{V}$ represents energy associated with, rather than stored in, the fluid and this term has energy significance *only* when motion is occurring and work is being done. Thus, although the product of the two properties P and $\overline{V}$ is itself a property, it is a term which signifies energy *only* when the fluid is in steady and continuous flow; for this reason $P\overline{V}$ is frequently referred to as the *flow work* associated with any fluid which is in a state of steady and continuous motion. When motion does not exist, the numerical value of the $P\overline{V}$ product is, of course, unchanged and its dimensions remain ft lbs per lb, but this value is meaningless except insofar as it shows how much energy *would* flow through the fluid *if* it were in motion. In every real sense, flow work is identical with shaft work and represents energy in transition.

Comparing the systems of Figs. 2 and 3, it appears that the substitution of a fluid for the center section of the rod in no way alters the method by which shaft work is transmitted. In some cases, however, great practical advantage accrues from the possibility of making such a substitution, since it permits transmission without the need of delivering the force along the closest approach to a straight line between the source and the receiver. Thus, suppose that an obstacle of some kind is interposed between the point of

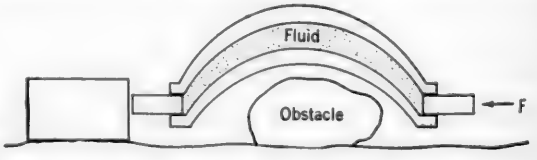


Fig. 4. Force conveyed through tube around an obstacle.

application of the force and the point at which the work is to flow from the system. In this case, Fig. 4, the entire mid-section of the rod can be replaced with a tube which can be bent around the obstacle without loss of effectiveness.

Figure 5 shows the equivalent but more practical arrangement of using cylinders with pistons at either end of the hydraulic system. Technically, the two systems have identical energy transmission characteristics, but the latter arrangement provides a greater degree of convenience. Thus, for all practical purposes, *any* stream of fluid which is moving steadily and continuously within a conduit is acting as the equivalent of a solid shaft and is transmitting energy as work along the conduit in the direction of flow. Irrespective of length or of cross section, the work which enters one end of the tube leaves the other end instantly (except for such part as may be lost due to friction in transit) and the rate of transmission of work will be entirely independent of the quantity of fluid within the conduit.

Loss of Energy

In all practical cases, some of the energy which enters a conduit as flow work undergoes either escape or transformation before reaching the other end, hence the energy actually delivered as work is less than the amount entering. Visualize a weight w which is to be raised through a distance L. A force F (equal in amount to w if applied directly to the underside of the weight) would do an amount of work equal to F(L), or w(L), in raising the weight, and the work delivered through application of the force would be transformed into external potential energy stored in the rod because of its higher position. If, however, the force were to be applied to the weight through a vertical rod as in Fig. 6, the required force acting at the bottom end of the rod would equal the sum of the weights of the rod and of the object. As the object was raised, that fraction of the work done which is equal to the rod weight times distance of travel would not be transmitted through the rod, but would go into external potential storage in the rod itself. Thus for this case (let w' equal the rod weight) the amount of energy entering the rod as work would be $(w + w')L$, whereas the amount leaving as work would be wL; the difference, $w'L$, would represent work transformed in the rod itself from energy in transition to energy in storage.

In exactly the same way as in the foregoing example,

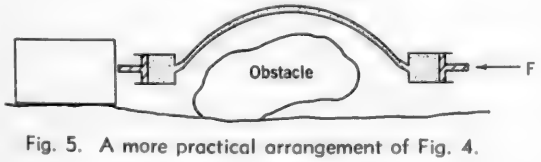
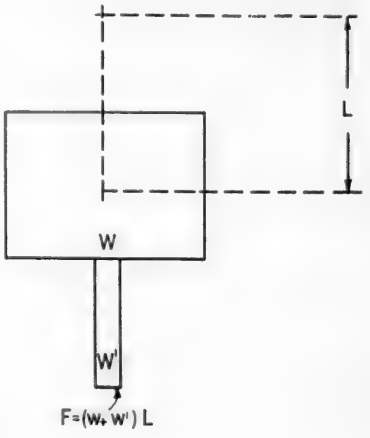


Fig. 5. A more practical arrangement of Fig. 4.

if the vertical rod were to be replaced with a conduit, the flow work entering at the lower end would be only partially transmitted as some of this energy would go into potential storage in the fluid itself. Since the total fluid pressure at any cross section of the conduit would be that due to the downward force exerted by the object and the downward force exerted by the fluid above the particular cross section, it follows that the pressure would progressively decrease as the cross section in question was considered to be at a progressively higher elevation. But the flow work transmitted by unit weight of fluid passing any cross section is $P\bar{V}$, hence the decreasing $P\bar{V}$ product would be indicative of the dimunition of transmitted

Fig. 6. Force applied through a vertical rod.



energy as a result of transformation to external potential energy storage in the fluid.

In various other types of systems, flow work may be transformed into external kinetic energy or into internal energy (as by internal fluid friction) or into heat (as by skin friction), but in all cases the $P\bar{V}$ product indicates the rate of flow of work per unit weight of fluid passing the particular cross section of the pipe.

Generalizing from the discussion given, it appears that a pipe line containing a fluid under steady and continuous flow acts as a transmission system for energy (as flow work) just as does a shaft, or an electrical transmission system. The primary advantage of the pipe over the shaft is that it is not limited in direction and, since the pipe itself is not moving, can be held with fixed supports. The disadvantage of the pipe as compared with the shaft is that the energy transmission is axial rather than circumferential and requires the continuous supply and discharge of some kind of fluid. Basically, however, both pipe and shaft serve as devices for transferring work. Consider, for example, a system in which water falls through a hydraulic turbine with the production (as a result of partial transformation of the external potential energy stored in the water) of shaft work.

Transfer of Energy from Turbine

If this work is needed to operate some type of machine located at a distance from the turbine, three evident possibilities exist for securing the transfer of energy from the turbine to the driven machine:

1. The turbine could be used to drive an electrical generator, electricity then being transmitted to the point of use and there transformed into shaft work (in an electric motor) for use in driving the machine. Needless to say, there would necessarily be losses at each stage of the path with consequent incomplete conversion, but a large fraction of the shaft work from the hydraulic turbine would nonetheless be delivered to the driven machine.

2. If the distance and relative location of the turbine and the driven machine would permit, a shaft or a series of connected shafts could be used to attain direct transfer of the energy from place of origin (as shaft work) to place of use.

3. The hydraulic turbine could be direct connected to a pump which would maintain a flow of water through a pipe to a second hydraulic turbine located adjacent to the machine which is to be driven. In this case, the pump transforms shaft work from the turbine to flow work for subsequent retransformation back to shaft work in the second hydraulic turbine. Neglecting pipe friction and assuming that flow in the pipe occurs horizontally and at negligibly low velocity, the sole function of the pump would be to convert work from shaft form to flow form. It is interesting to note that (for the assumed frictionless system) *no* energy is required or used in transferring the water from the one location to the other. The water acts merely as a medium for transmitting the flow work and the motion of the water through the pipe corresponds to the action of a force in the fundamental work equation. Fluid transmission systems find many engineering applications and in all cases are treated as identical with systems for the transfer of work through a shaft. To all intents and purposes the fluid within the pipe of such a system is a flexible shaft which moves as work is done and which is restrained in its path by the surrounding shell of pipe.

Energy Significance of Pressure

Since $P\overline{V}$ represents flow work associated with unit weight of fluid, ft lbs per lb, it follows that dividing by the specific volume will give the flow work associated with unit volume of fluid in foot pounds per cubic foot. But $P\overline{V}/\overline{V} = P$, and hence it is evident that, in addition to its importance as a measurable property, pressure is also of significance as an energy term indicative of the rate of transmission of work, per unit volume, through a fluid which is in steady and continuous motion.

This dual role of pressure requires special care in interpretation. Pressure as a property ***always*** exists and always can be expressed in units of pounds per square foot absolute. Pressure as an energy term, however, is of significance *only* when the fluid is in steady and continuous motion. Its units are then foot pounds per cubic foot, but though the absolute value of the pressure may not change when motion ceases, the meaning of the energy units will at that time entirely disappear. The energy significance of pressure depends on motion, but is independent of the magnitude of the motion; whether the flow velocity is very large or infinitesimally small, the amount of flow work associated with unit volume remains the same, but when motion ceases, this energy quantity instantly becomes zero, even though the pressure, as a property, remains unchanged.

In some fields of engineering, as in the design of piping systems, convention dictates the use of pressure as a property (with units of pounds per square foot) even though the conditions of use indicate that it is the energy significance that is actually of interest. Thus in piping problems, pressure drop is used as indicative of the loss of energy due to turbulence or to skin friction in a pipe line. Actually the decrease of energy results not from loss of pressure as a property, but from loss of flow work, hence from decrease in pressure when expressed as an energy term with units of ft lb per cu ft. Since the decrease in pressure is proportional to the decrease in energy, it is obviously of no practical concern whether the pressure be expressed as a force per unit area or as work per unit volume, but if the engineer is to develop a correct visualization of the relationships involved in any problem, he should at all times be aware as to which of these two concepts is the one of significance. See Example 1.

Example 1

Example: A liquid under pressure of 60 psia is flowing steadily and continuously through a pipe. The density of the liquid is not known. Determine the flow work associated with unit volume.

Solution: Flow work per unit volume, in units of ft lb per cu ft, is numerically equal to pressure in units of psfa; therefore, multiplying by 144 to convert the square inch unit to square feet,

Flow work = (60)(144) = 8640 ft lb per cu ft

Enthalpy

Neglecting mechanical energy and assuming flow through an insulated pipe, the two forms of energy stored in or associated with the fluid will be internal energy in storage and flow work in transition. Since the expression for flow work, $P\overline{V}$, is a product of properties, it must itself be a property and it will remain a property irrespective of whether, as a product, it is possessed of energy significance. The expression for internal energy, u, is likewise a property and since any combination of properties must itself be a property, it follows that we can define a new property, enthalpy, by the equation,

$$h = u + AP\overline{V} \text{ Btu per lb} \qquad (3)$$

where the coefficient A is used to change the units of the $P\overline{V}$ product from ft lbs per lb to thermal units of Btu per lb.

Since enthalpy is defined by equation 3, it follows that it is an arbitrarily selected term having units of Btu per lb, but only having valid energy significance if and when the APV product has such significance. Thus enthalpy, like flow work, is sometimes an energy term and sometimes not, depending on whether the fluid is in steady and continuous motion. By far the greater number of processes considered in heat-power or air conditioning involve the consideration of steady motion, hence permit use of enthalpy as representing the sum of internal energy and associated flow work, but in those cases where motion ceases the energy significance of this term must also cease even though, as is usually the case, its numerical value remains unchanged. See Example 2.

Two Energy Quantities Considered

Although dimensionally consistent, enthalpy is somewhat of an anomaly since it represents, for a fluid in motion, the sum of two energy quantities one of which is in storage and the other in transition. This distinction must always be remembered since the treatment of stored and transferred energy must often be different and in such cases some confusion might exist as to the method of handling enthalpy. Thus if w pounds of fluid are flowing in a pipe, the product wu is equal to the total internal

energy stored in the fluid and the term, *wh*, is by definition, the total enthalpy. But, whereas *wu* corresponds to an actual energy quantity, *wh* does not. The total enthalpy, *wh*, is no more than a number, without reference to any existing energy quantity, which is indicative of the energy that would be delivered, either in stored form or as flow work, *if w* pounds of fluid were forced across a given cross section of the pipe.

There is a wide variety of ways in which the property enthalpy finds use in engineering, but the most important and most common use in cases where steady flow exists and where *h* is, therefore, equal to the sum of internal energy and associated flow work. Since internal energy and flow work are the only two practical means of transferring large quantities of energy from the source to the place of utilization, it follows that the property enthalpy will find widespread use in all varieties of engineering applications.

Example 2

Example: A vapor at a pressure of 100 psia has a specific volume of 4.432 cu ft per lb and an enthalpy of 1187.2 Btu per lb. (a). Calculate the quantity of energy needed to place one pound of this fluid in steady and continuous motion; (b). Determine the amount of energy associated with unit weight of the fluid when at rest; (c). Determine the amount of energy associated with unit weight of the fluid when in steady and continuous motion.

Solution: (a). The energy needed to impart steady and continuous motion is equal to the flow work,

APV = (100)(144)(4.432)/778 = 82 Btu per lb

(b). The only energy associated with the fluid when it is at rest is its internal energy,

u = h — APV = 1187.2 — 82 = 1105.2 Btu per lb

(c). When in steady and continuous motion, the energy associated with unit weight of fluid is equal to its enthalpy or 1187.2 Btu per lb.

(Note that the enthalpy of the fluid at rest retains significance as a property — with value of 1187.2 Btu per lb—but has no energy significance.)

Work of Constant Pressure Expansion

Both shaft work and flow work utilize the working substance, whether shaft or fluid, solely as a path through which work is transmitted. In contrast with this situation, work can also be realized due to the expansion of the working substance, but, in this case, the fluid acts primarily as an agent for partially transforming energy from some thermal form to work.

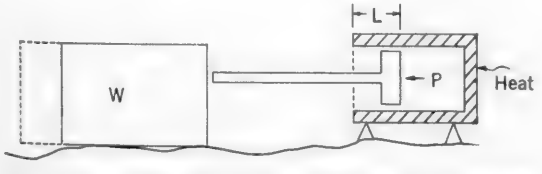


Fig. 7. Force applied to a weight through a frictionless piston.

Referring to Fig. 7, for example, consider a cylinder filled with any working substance and arranged with a frictionless piston which is to apply force to a weight. As the fluid within the cylinder is heated, its temperature and pressure tend to rise, under conditions of constant volume, until the pressure provides a force against the piston just sufficient to overcome the frictional resistance of the weight. Up to this point all of the thermal energy added to the fluid has gone into storage as internal energy and the amount of energy added in raising the temperature from an initial value t_1 to the final value t_2 would be,

$$\triangle u = c_v\ (t_2 - t_1)\ \text{(constant volume)} \qquad (4)$$

where c_v is the specific heat at constant volume. From this point on no increase in pressure would occur, but further addition of thermal energy would lead to expansion of the fluid with consequent movement of the piston and discharge through the rod of shaft work for delivery to the object. As in all cases involving work, the amount of energy so delivered would equal the product of force acting on the rod multiplied by distance of travel, but the force would equal the fluid pressure times the cylinder area. Hence, the shaft work delivered as a result of fluid expansion would be:

$$\text{Work of Expansion} = P(A)(L)$$

where L is the distance of travel. But $A(L)$ is equal to the change in volume, or expansion, of the fluid within the cylinder, hence the previously stated equation can be written more simply as:

$$\text{Work of Expansion (constant pressure)} = P\triangle V = P(V_2 - V_1) \qquad (5)$$

where V_2 and V_1 are, respectively, the final and the initial volumes of fluid in the cylinder.

Consideration will readily show that equation 5 is applicable to any system in which fluid expansion occurs against constant pressure, irrespective of whether or not the expansion is in one, two, or all three directions. In a case such as that of spherical expansion, the work done by the expanding fluid acts against the pressure of the atmosphere and, in effect, "lifts" the earth's atmosphere envelope through an infinitesimally small height thereby putting into external potential storage, in that envelope, an amount of energy equal to the work required to achieve the expansion. (In expanding against the wall of a rubber balloon, the condition of constant pressure would not be realized as the work expended by the fluid would go partially into external potential storage in the earth's atmosphere and partially into similar storage in the stressed surface of the balloon itself.)

Thus the ability of a material to increase in volume as a result of temperature rise is of paramount importance in achieving the partial transformation of thermal energy into work. Since different materials vary widely in their expansion characteristics, it is evidently important that a working substance be selected which will have a suitable characteristic of thermal expansion. In general, solids provide a minimum of expansion, liquids somewhat more, and gases or vapors provide the greatest attainable degree of expansion. Even with solids, however, the work done during thermal expansion is of great importance and if

not allowed for in structural design—as for refrigerant compressors, furnaces, or ducting—severe damage can be done. Occasional attempts have been made to usefully harness the expansion and contraction of solids; one European manufacturer has produced a clock which is automatically wound as a result of work done due to diurnal expansion and contraction, with temperature change, of a metal bar.

For a constant pressure process the work done during expansion has been shown to be equal to $P\triangle V$, or in thermal units $AP\triangle V$, hence the total increase of energy of one pound of fluid, as a result of a one degree Fahrenheit temperature increase, is

$$\triangle u + AP\triangle V = \triangle u_{kin.} + \triangle u_{pot.} + AP\triangle V = c_v + \triangle u_{pot.} + AP\triangle V = c_p \qquad (6)$$

where u is internal energy in Btu per pound of substance and c_p is defined as the specific heat at constant pressure. Note that the term, c_p, defined in terms of properties, hence itself a property, possesses energy significance only for a constant pressure process. Even when so used, c_p is an anomaly like enthalpy, since it represents the sum of two types of energy quantities, one of which is going into (or out of) storage, whereas the other is indicative of energy in transition. See Example 3.

Example 3

Example: A certain gas has specific heats at constant pressure and at constant volume of 0.25 and 0.15, respectively. Determine the increase in specific volume if 20 Btu are added to one pound of this gas at a constant pressure of 200 psia.

Solution: For this case, assuming perfect gas behavior, equation 6 takes the form,

$$\triangle u + AP\triangle V = c_v\triangle t + AP\triangle V = c_p\triangle t$$

where the total energy addition, $\triangle u + AP\triangle V$, is equal to 20 Btu. Then,

$$20 = c_p\triangle t = 0.25\triangle t$$

or

$$\triangle t = 20/0.25 = 80F$$

and

$$20 = c_v\triangle t + AP\triangle V = (0.15)(80) + (200)(144)(\triangle V)/778$$

giving

$$\triangle V = 0.216 \text{ cu ft per lb}$$

Specific Heat

For all working substances which expand as they undergo a temperature increase, the numerical value of the specific heat at constant pressure exceeds that of the specific heat at constant volume. The difference between the two, as shown in equation 6, represents either energy going to internal potential storage or work done by the fluid during expansion. In those rare cases where a material decreases in volume while its temperature is being raised (as water between the temperatures 33F and 36F) work is done *on* the fluid, hence the work term in equation 6 is negative, and, for such cases, the specific heat at constant pressure is *less* than the specific heat at constant volume.

From equation 6, it is evident that a highly prized characteristic of a working substance would be a large difference between c_p and c_v, since this difference largely represents the conversion of thermal energy into work as a result of the process of expansion. Unfortunately the difference is not great for most practicable working substances, and, in consequence, the opportunity for efficient conversion of thermal energy to shaft work through fluid expansion is extremely limited. See Example 4.

Example 4

Example: For air, the values of c_p and c_v are respectively, 0.24 and 0.17 Btu per (lb) (F), hence during a constant pressure process 0.24 — 0.17 or 0.07 Btu of thermal energy are converted to work for each one degree Fahrenheit temperature rise of one pound of working fluid. Thus the thermal efficiency for a constant pressure air process is 0.07/0.24 = 0.29 or 29%. In large measure the more complex processes and cycles of thermodynamics represent attempts, some partially successful, to attain a thermal efficiency greater than that indicated by this relationship.

The distinction should be recognized between work delivered by a fluid and work transformed within a fluid. Referring to Figs. 5 and 7, in the first case the work done on the piston is equal to the term $P\triangle V$ where $\triangle V$ is equal to the *increase* in total volume of the fluid within the receiving cylinder; in this case P represents the flow work per unit volume and $\triangle V$ is the volume of fluid entering the cylinder, hence the product $P\triangle V$ corresponds to energy *transmitted* from entering fluid to piston as *flow work*. The energy comes from some external and unidentified source, as a pump, and the state of fluid within the cylinder does not change during the process.

In the second case (refer to Fig. 7) the situation is markedly different although the same term, $P\triangle V$, is indicative of the work delivered to the piston. In this case no fluid is admitted to the cylinder, hence the energy delivered as work to the piston must come wholly from the energy which is added to the constant weight of fluid within the cylinder from some exterior, but adjacent, thermal source. In this latter case, the fluid originally in the cylinder acts as an agent for achieving the transformation of thermal energy to shaft work (as work of fluid expansion) in contrast with the previous case where the fluid within the cylinder serves merely to transmit energy from some distant *flow work* source.

Latent Heat of Vaporization

When a liquid is used as a working substance, work of expansion is done during the process of evaporation. For a constant pressure evaporative process, the temperature remains constant, but a large amount of energy goes into internal potential storage and, at the same time, the volume increase associated with the change of phase from liquid to vapor causes delivery of work of expansion to whatever the fluid expands against. Refer to Fig. 7 and consider that an evaporating liquid is to be used as a means of transforming thermal energy into shaft work, thereby moving the object against the force of friction. Visualize the cylinder as containing water under a pressure of 20 psia and assume that this is just sufficient to equal the opposing frictional force. Now as thermal energy is added to the fluid in the cylinder, it will evaporate at constant temperature and at constant pressure, the pis-

ton moving to the left and delivering work through the rod to the object. See Example 5.

Example 5

Example: In order to evaporate one pound of water at constant pressure of 20 psia, a total of 960.1 Btu must be added and a volume increase of slightly more than 20 cu ft will occur. The amount of work done during evaporation will therefore be $P\triangle V = 20(144)(20) = 57{,}600$ ft lb per lb or $57600/778 = 73$ Btu. The efficiency of this expansion process, used as a means of transforming thermal energy to work, is $73/960.1 = 7.6\%$. Of the work delivered, however, by far the greater part is used in pushing back the atmosphere and the part available for moving the object amounts only to $144(20 - 14.7)20/788 = 19.6$ Btu, hence the efficiency of the system evaluated in terms of useful work is only $19.6/960.1 = 2\%$.

In any expansion process work must be done in pushing back the atmosphere. It is evident, therefore, that the effectiveness of the process will increase as the pressure increases, since the ratio of absolute pressure to atmospheric pressure will be equal to the ratio of total work to work done on the atmosphere. On the other hand, the amount of expansion during evaporation decreases with increasing pressure, hence an investigation is necessary to determine where greatest advantage is to be found. See Example 6.

Example 6

Example: Consider one pound of water under a pressure of 1000 psia. To achieve evaporation, 649.4 Btu must be added and the corresponding volume increase amounts to approximately 0.42 cu ft. The thermal equivalent of the total work of expansion is then $144(1000)(0.42)/778 = 77.8$ Btu and the thermal efficiency of the overall transformation is $77.8/649.4 = 12\%$ as contrasted with the 7.6% that was found (in the preceding example) at 20 psia. The efficiency evaluated in terms of work delivered other than to the atmosphere is $12(1000 - 14.7)/1000 = 11.8\%$ as compared with 2% for the 20 psia system.

At 3000 psia, the energy required for evaporation of 1 lb water is 217.8 Btu and the corresponding volume increase amounts to 0.0512 cu ft. The work done is $144(3000)(0.0512)/778 = 28.5$ Btu and the overall thermal efficiency is $28.5/217.8 = 13.1\%$, whereas the efficiency in terms of work done other than on the atmosphere is $13.1(3000 - 14.7)/3000 = 13\%$.

At the other end of the pressure range, the energy added in evaporating 1 lb of water at 0.1 psia is 1074.1 and the volume increase is 2947 cu ft. Hence, the work done amounts to $144(0.1)(2947)/778 = 54.6$ Btu. The overall thermal efficiency is $54.6/1074.1 = 5.1\%$. In this case expansion could not occur against atmospheric pressure since the liquid is under a high vacuum.

Summarizing, it is evident that the effectiveness of phase change as a means of transforming thermal energy to work increases with pressure; it is for this reason, though for other reasons also, that the trend in design of steam power plants is toward operation at the highest pressure that the materials of construction that are used will permit.

The thermal energy input to a liquid to achieve evaporation is defined as the latent heat of vaporization and is indicated by the symbol, h_{fg}. As already noted the latent heat goes partially into potential storage and is partially dissipated as work done during expansion, thus one can write,

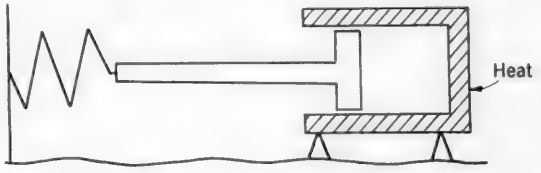


Fig. 8. Work done against the resistance of a spring.

$$h_{fg} = \triangle u + AP\triangle V \qquad (7)$$

which is of the same form as equation 6, but, since the process occurs at constant temperature, it is not possible to express the latent heat of vaporization in terms of a specific heat.

During condensation of a vapor at atmospheric pressure, an amount of thermal energy equal to h_{fg} is liberated, but again one must note that this energy comes only in part from storage in the vapor; the remaining fraction is a transformation of external potential energy stored in the atmosphere to work done in reducing the volume of the vapor as it undergoes phase change to a liquid. This work is then transformed to thermal energy and leaves the fluid as heat.

Latent Heat of Fusion

The primary energy difference between a phase change from liquid to vapor and one from solid to liquid is that in the latter case the change in volume is very much less than in the former, hence by far the greater part of the energy which must be added to achieve the phase change goes into internal potential storage. For most solids there is a volume increase as liquefication occurs, hence the usual equation for latent heat of fusion is similar in form to equation 7,

$$h_{fs} = \triangle u + AP\triangle V \qquad (8)$$

In some cases, however, of which the phase change from ice to water is an example, there is a volume decrease during the phase change, hence work is done *on* the material and the change of internal potential energy then exceeds the latent heat of fusion. Such special cases can be readily treated by equation 8 provided the $\triangle V$ term is considered to represent an increase rather than merely a change in volume; on this basis the $AP\triangle V$ term of the equation would be negative for materials which shrink during melting.

Work of Variable Pressure Expansion

In the systems which have just been considered, a constant resisting force is provided by friction between the object and the ground. If the system is altered, as in Fig. 8, so that work is done against the resistance of a spring, the required force will increase uniformly as the spring contracts. In this case the pressure within the

cylinder will necessarily increase as expansion takes place. The work equation will then involve a force which varies as a function of distance and the equation must therefore be written in integral form.

Fig. 9. Plot of force against distance.

$$Wk = \int FdL \qquad (9)$$

For a spring in which force is directly proportional to distance, the spring constant, K, can be defined by the equation,

$$K = F/L \text{ or } F = KL$$

which substituted in the work equation gives,

$$Wk = K \int LdL = KL^2/2 \Big|_{L=0}^{L=L} = KL^2/2 \text{ ft lb} \qquad (10)$$

A plot of force against distance, as Fig. 9, would show the force increasing continuously; the work done *on* the spring would then be proportional to the area under the curve.

The work done *by* the expanding fluid is given by the equation,

$$Wk = \int PdV \qquad (11)$$

But since F is equal to KL, it follows that $P = KL/A = K'L$, and, since $V - V_o$ is proportional to L, we can write $P = K''(V - V_o)$ or,

$$Wk = \int PdV = K'' \int (V - V_o)\,dV = K'' \left(\frac{V^2}{2} - VV_o\right)\Big|_{V_o}^{V} \qquad (12)$$

$$= K'' \left\{ (V^2_o/2) - (V_oV) + (V^2/2) \right\} = 0.5K''(V - V_o)^2$$

Figure 10 shows pressure plotted as a function of volume and the area under the process curve is equal to $\int PdV$ or the work. For this particular process, since pressure varies as a lineal function of volume, the area under the curve is equal to the average pressure times the volume change or $0.5\,P(V - V_o)$. But since $P = K''(V - V_o)$, it follows that the work is equal to,

$$Wk = 0.5\,K''(V - V_o)^2 \qquad (13)$$

which checks the value obtained by integration.

If the relationship between spring constant and distance were not subject to convenient mathematical definition, the work would be obtained most easily by plotting the pressure-volume diagram and obtaining the area under the curve by graphical integration. When this method is used, the pressure curve is broken up into a series of short sections which can be treated as constant pressure processes, Fig. 11. The increment of pressure between steps is assumed to occur discontinuously. By increasing the number of processes, the summation can be made to approach more and more closely the shape of the actual pressure-volume curve; any desired degree of accuracy can be obtained though at the expense of added effort in computation.

In most actual variable-pressure processes the pressure of the working fluid decreases, rather than increases, as a function of increased volume. In theory there are as many possible paths of fluid expansion as there are possible connecting lines between initial and final state on the pressure-volume diagram. In usual engineering practice, however, the most common expansion processes are those which maintain constancy of some one fluid property or which maintain a fixed relationship between two properties. The work output during particular types of expansion processes will be investigated in following sections, but the reader should at this point recall that such processes are on the nonflow type. In the event that flow occurs, the entire analysis must be drastically altered, since for a flow process, the weight of fluid within the cylinder will vary. Note, however, that the fundamental work equation, $\int PdV$, says nothing whatsoever concerning the weight of fluid under consideration, hence this equation will accurately determine the work of the expansion process whether flow or nonflow provided only that the relationship which exists between P and V can be explicitly stated.

Since the PV diagram is merely a representation of the work equation, it follows that the area under the process line on this diagram is numerically equal to the work regardless of whether the process occurs under the flow or nonflow conditions. Referring to Fig. 12 note that in the case identified as *a*, the piston moves under constant pressure due to admission of fluid and the entering fluid transfers its associated flow work to the shaft; in case *b*, the cylinder contains a fixed weight of fluid which ex-

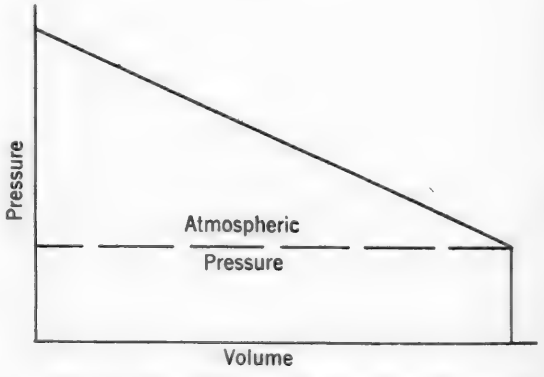


Fig. 10. Pressure plotted as a function of volume.

pands at constant pressure as thermal energy is added and a partial transformation occurs of the thermal energy to shaft work. The energy relationships of these two cases are entirely different, but the work effects are identical and, as shown on the respective PV diagrams, are indistinguishable. In one important respect, however, the *PV* diagrams are markedly different, since points on the diagram for a nonflow process identify state points of the working substance, whereas points on the diagram for flow process have no state-point significance; this is true because the nonflow diagram relates the two *properties* P and V (since w is constant), whereas the flow diagram relates one property P, and a non-property (total volume, V). Any *PV* diagram gives complete information concerning the work of the process, but it permits process identification only when its coordinates are fluid *properties.*

Work of Isothermal Expansion

An obvious objection to the expansion processes which have so far been considered is that the temperature of the working substance increases as work is done, hence a large fraction of the added thermal energy goes to internal kinetic storage with consequent reduction in the amount of energy converted to useful work. When a gas or vapor is used as the working substance, the *process* thermal efficiency can be raised to practically 100% (assuming no friction losses) by controlling the variable resistance against which the piston moves, so that the expansion can be made to occur isothermally, hence with no change in the kinetic fraction of internal energy. But for a gas or superheated vapor, there is no appreciable change in the potential fraction of internal energy as a function of volume, hence practically all the thermal energy added to the fluid will be transformed to work of expansion.

As compared with the other processes which have been considered, it is evident that the isothermal is the only one

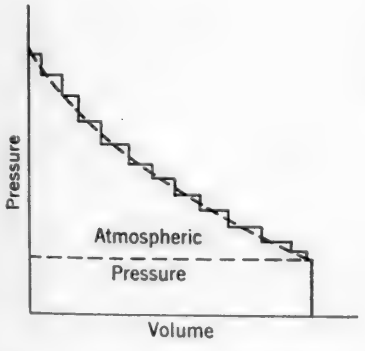


Fig. 11. Pressure curve broken up into increments.

that fully meets the requirement of a thermodynamic path along which thermal energy can be fully transformed to work; in every sense, the isothermal process is an ideal one and it is the *only* process which permits—in theory—a 100% conversion of thermal energy input to work output. If thermodynamic interest were limited to a single process, the need for further investigation would not exist, *but* in order to apply thermodynamics to useful equipments it is necessary to develop cycles rather than isolated processes. The 100% efficiency of the isothermal process is by no means realized in any of the cycles in which isothermals make up part of the closed path.

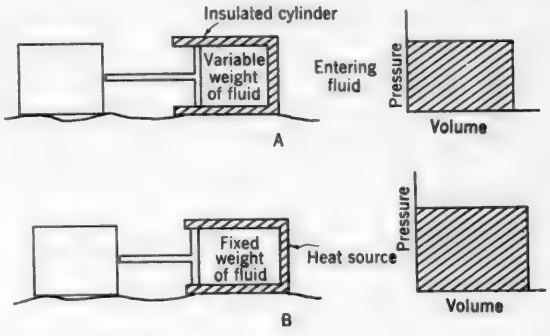


Fig. 12. At (a) piston moves at constant pressure and at (b) there is a fixed weight of fluid in the cylinder.

Work of Adiabatic and Isentropic Expansion

Whenever expansion occurs, it is due to a difference, or a tendency towards a difference, in pressure. Thus pressure is that intensive fluid property whose value indicates the potentiality for expansion. The pressure is not itself the source of energy which leaves as work during the expansion process, but the value of the pressure does serve to indicate whether or not there is any likelihood that an energy conversion will take place. In one respect, therefore, pressure is a kind of potential indicating the possibility as well as the direction of an expansion process.

In all of the various processes which have so far been considered, energy from an outside source was converted wholly or in part to work of expansion. Consider now a special type of process in which there is no outside energy source and such work as is done is derived from energy which leaves storage in the working substance. The limiting process of this type, defined as an adiabatic, is one in which the cylinder is assumed to be perfectly insulated, hence no thermal exchange occurs between the fluid and the surroundings. In this case, the work delivered during expansion against a constantly decreasing pressure would have to come from internal energy, hence (except for phase change) would necessarily lead to temperature reduction. The amount of work delivered by an adiabatic process is determined by the extent of losses due to friction between fluid and cylinder walls and internal friction within the fluid itself. For an ideal adiabatic, one which occurs without such frictional losses, the work output is a maximum and the process is defined as an *isentropic.*

The adiabatic and isentropic processes illustrate a third source of the energy which appears as work of expansion. The first source was flow work passing from the fluid without change in its state, the second was thermal energy passing through the fluid with an associated change of state, whereas this third source is internal energy taken from the fluid as it undergoes a state change. For each of these three cases the work done by the expanding substance is the area under the curve of the PV diagram and no distinction is made as to the energy source. In short, the work equation and the PV diagram express the rela-

tionship between work done and pressure-volume history, but the equation and the diagram provide no information whatsoever as to the *source* of the energy which leaves the fluid as work.

Work of Polytropic Expansion

Preceding sections have included discussions of some few of the multitude of paths along which a fluid can expand. The problem of classifying and analyzing such processes would obviously be greatly simplified if some common characteristic could be found which would permit establishing a general work relationship for all of the more common processes, each particular process then being identified by some special form of the general equation. One method of approach would be to examine the various *PV* process curves and seek a mathematical statement or equation for all the more important processes as members of a given family of curves. This has been done and experience shows that all of the expansion processes that are commonly utilized in thermodynamic analyses are special forms of the so-called *polytropic*, for which the relationship between pressure and volume is defined by the equation,

$$PV^n = \text{constant}$$

or

$$P_1V^n_1 = P_2V^n_2 \qquad (14)$$

One must note that the above equation is not derived from thermodynamic considerations, but is rather based on the "fitting" of innumerable expansion curves from actual operating equipments. It is solely a statement of observed experience, but a statement of very great utility, since relationships developed in terms of the generalized exponent, n, can be readily adapted to all actual processes once the defining exponent for the particular process has been established. The equation makes no statement concerning the type of working substance, hence is equally applicable to vapors, to actual gases, or what are termed ideal gases.

The definition of a polytropic establishes the relationship between pressure and volume, thus permitting substitution in the work equation of a volume function in place of pressure. This makes possible integration of the equation for *any* path which meets the polytropic condition. Thus, solving the polytropic equation for *P*, there results

$$P = (P_1V^n_1)/V^n$$

and substituting for *P* in the work equation,

$$Wk = \int PdV = P_1V^n_1 \int (dV/V^n)$$

$$= P_1V^n_1(V^{n-1})/(n-1) \Big|_{V_1}^{V_2}$$

$$= (P_2V_2 - P_1V_1)/(n-1) \text{ ft lbs} \qquad (15)$$

which gives the work done during the process of polytropic expansion from any initial state 1 to any subsequent state 2. See example 7.

Example 7

Example: A vapor is compressed polytropically from 25 psia to 165 psia and undergoes an associated volume reduction from 11 cu ft to 2.4 cu ft. Determine the work required for this compression process.

Solution: Before attempting evaluation of the work, it is necessary to determine the exponent for the particular polytropic. Changing the form of equation 14,

$$(V_2/V_1)^n = P_1/P_2$$

giving

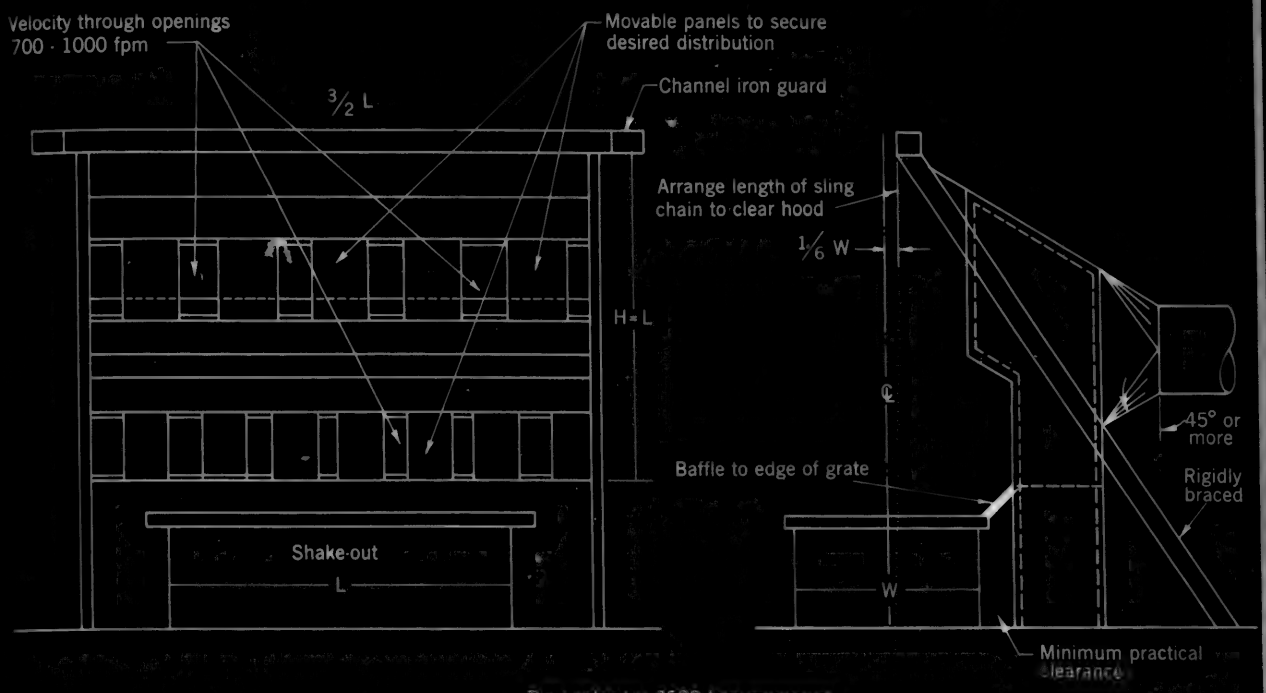
$$n = \log(P_2/P_1)/\log(V_1/V_2) = \log(165/25)/\log(2.4/11) = 1.24$$

Then substituting into equation 15

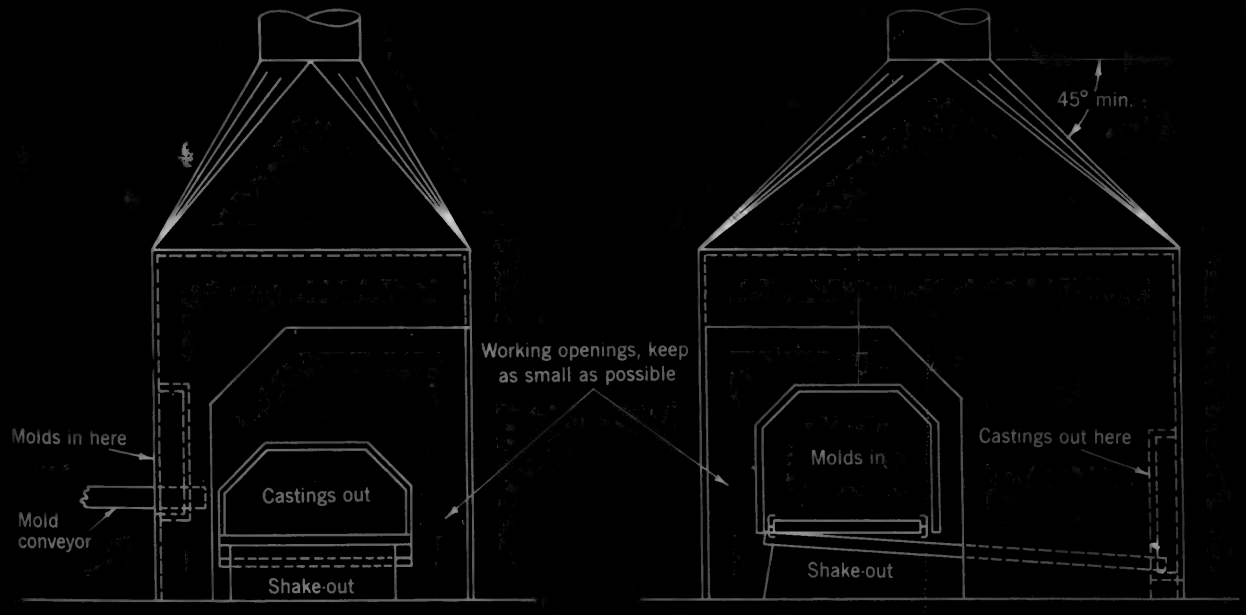
$$\text{Process work} = 144[(165)(2.4) - (25)(11)]/(1.24 - 1) = 72600 \text{ ft lbs.}$$

Application of equation 14 depends on evaluation of the polytropic exponent. For $n = 0$, $P_1 = P_2$ so the process is one occuring at constant pressure. For this case the work (by equation 14) is $P\triangle V$ which correpsonds to the value determined by direct consideration of a constant pressure process. For $n = \infty$, $V_1 = V_2$, and, for such a constant volume process, the work is zero. For $n = 1$, $P_1V_1 = P_2V_2$ and equation 14 becomes indeterminate, (o/o), but for a working substance which behaves like a perfect gas, the process (by the perfect gas law) is an isothermal.

DETAILS OF A FOUNDRY SHAKEOUT



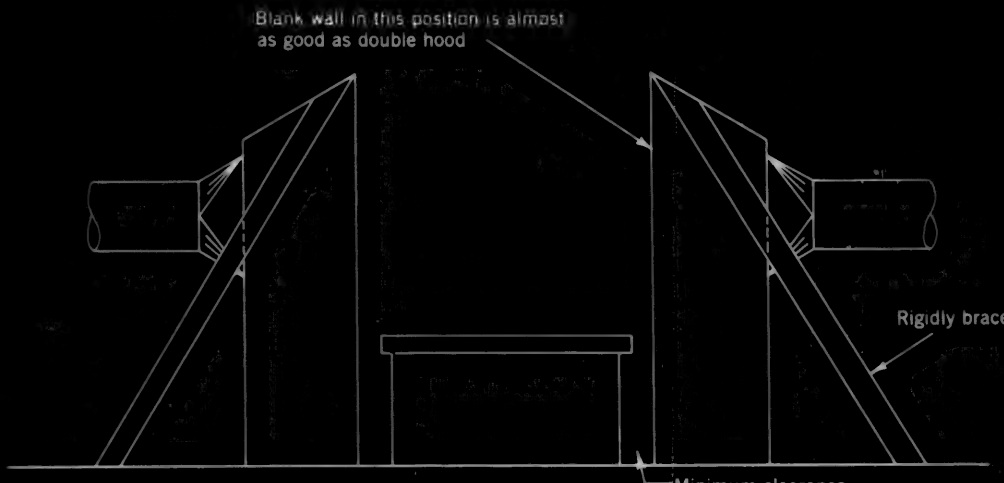
Duct velocity = 3500 fpm minimum
Entry loss = 1.78 slot VP + 0.25 duct VP
SIDE DRAFT HOOD



Provides best control with least volume
Duct velocity = 3500 fpm minimum
Entry loss = 0.25 VP
ENCLOSING HOOD

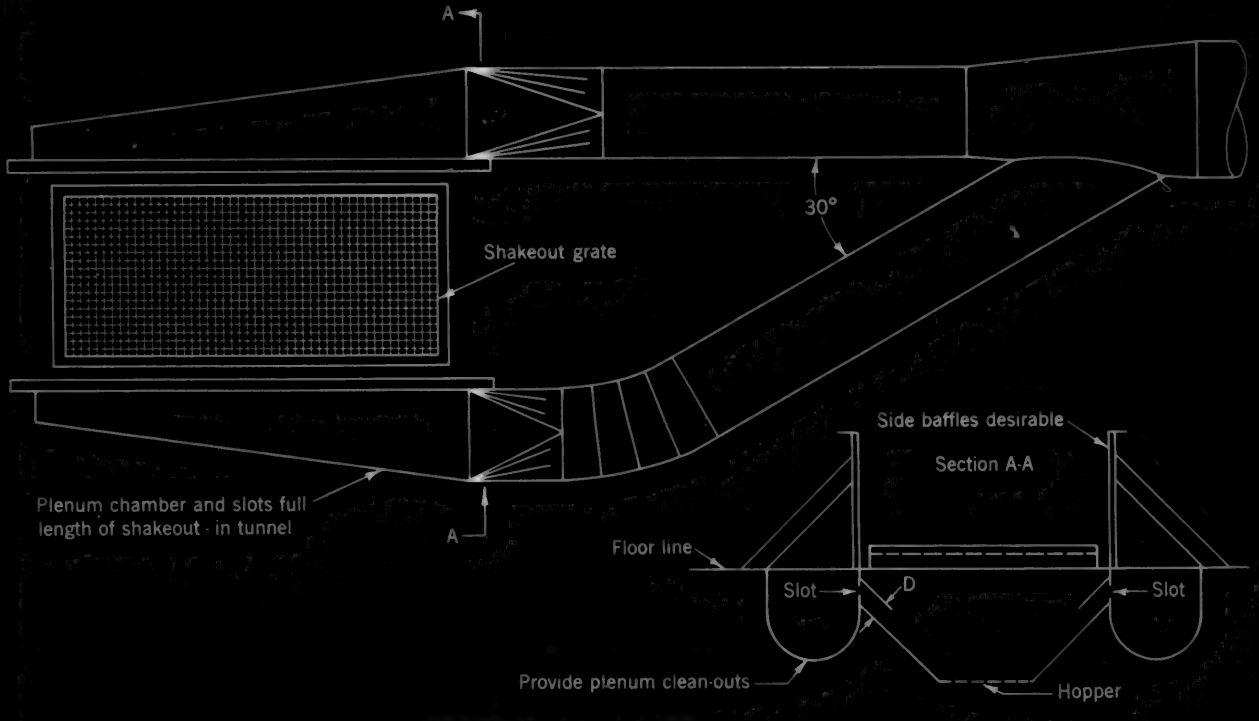
HEATING AND VENTILATING'S DETAIL SHEET

DETAILS OF A FOUNDRY SHAKEOUT



Proportions same as single side-draft hood except for overhang

DOUBLE SIDE DRAFT



Slots sized for 1500 - 2000 fpm
Duct velocity = 4000 fpm minimum
Size D for 1000 fpm or less
Entry loss = 1.78 slot VP plus fittings
Hood is for cool castings only
It is difficult to prevent plugging or excess fines removal

DOWN DRAFT HOOD

DETAILS COURTESY, AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS

HEATING AND VENTILATING'S DETAIL SHEET

Fig. 1. Raw materials are unloaded into a hopper on the north side of the new Austin designed Penn-Rillton plant, here viewed from the southwest. The high section of the plant is the manufacturing area, faced with corrugated asbestos siding. The brick-faced one-story section houses offices, toilet and locker facilities, and the boiler and electric control center.

Automation for Dust-Free Coal Processing

THERE is an inkling of dust-free conditions to come in the foundry industry and the rapidly expanding field of coal chemistry in a little box-like factory building down on the Monongahela River at West Elizabeth, Pa. It houses one of the most concentrated and completely automatic installations of materials handling and processing equipment ever packed into an area of comparable size.

The plant, recently placed in operation by Penn-Rillton Company, which processes lump coal and coal tar pitch into fine pulverized foundry mold facing and core binder materials, sets new standards in dust control and dust collection. With an intricate maze of pulverizing, conveying and blending equipment and two 100-ton storage silos concentrated in 2,400 sq ft of floor space which has an initial daily processing capacity of 140 tons of bagged and finished products, there is plenty of room for expansion in the 7,400 sq ft manufacturing area.

Foolproof interlocking automatic controls, explosion-proof motors and electrical equipment, and an all-inclusive dust control and collection system have been provided by The Austin Company, which designed the plant and processing installation in the interests of efficiency, economy and safety, as well as working conditions.

Because of the character of this equipment and the built-in flexibility of the materials handling system, maintenance and production personnel are limited almost entirely to the number required to man the bagging machines and to handle the finished product to and from storage or the shipping platform.

Lump coal and dry coal tar pitch are the principal raw materials required by the plant. These are received by rail from nearby mines and unloaded directly into the car hopper on the north side of the building (Fig. 1). They travel on a belt conveyor to a single roll crusher, then are carried up to the top of the building by a bucket elevator.

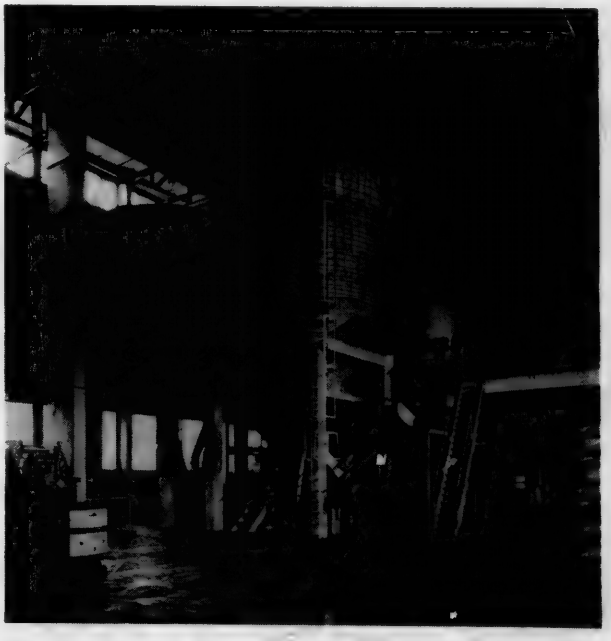


Fig. 2. Compact arrangement of equipment permits future expansion of the process system within the present structure. Pitch storage silo is at left, sea coal silo at right. Raw materials pass up bucket elevator at left, through screw conveyors, thence to respective silos. Note dust collecting hood and ducts above elevator.

Fig. 3. Screw conveyor running up at angle from storage bin at upper left connects the sea coal line to the pitch line so that materials can be blended. Just above it, running to right, is another screw conveyor that feeds back oversize material to sea coal pulverizers for reprocessing. Roller chain drive in lower left is dust and oil tight, as are all screw conveyor drives in plant. Seventy-five horsepower motor in foreground, here driving pitch pulverizer, is identical with two motors driving sea coal pulverizers.

Passing through screw conveyors, the coal and pitch are delivered to their respective storage silos, of 100-ton capacity (Fig. 2). Thence they pass through any of a number of combinations of pulverizers, screens, separators and other equipment (Fig. 3), and are reduced to minus 200 mesh or finer before they arrive at bagging machines on the main floor. Bags of finished products then move to the warehouse area, on the east side of the plant, to await shipment (Fig. 4).

The combinations of equipment through which the materials pass are regulated according to the composition and grain sizes desired in the finished products. The coal and pitch are sometimes combined, in a number of proportions. In addition, various other substances, including goulac, clay and dextrine, are mixed with the pitch to produce core binders with special properties.

Because of the nature of the raw materials and products processed in the plant, a highly efficient dust collecting system was necessary. (Figs. 5 and 6). Yet the mass of equipment installed occupies remarkably little floor space and the plant as now constructed provides room for considerable expansion of processing facilities in the future. In addition, the structure was so located that it may be extended in two directions if and when desired.

Fig. 4. Interior of railroad car being loaded with pulverized sea coal. Interior of manufacturing area may be seen through door on covered loading platform.

The manufacturing area at present measures 100 ft by 74 ft, with a clear area of 40 ft from the floor to the base of the trusses. Only 2,400 sq ft of floor space is needed for the two 100-ton storage silos, with all their related equipment and machinery. Room has been left for six more silos of the same size. Since the structure can be extended 135 feet to the north and 170 feet to the east, the present potential capacity of eight silos can be multiplied several times.

The entire conveying and processing installation is completely enclosed and dust-tight. A negative pressure is maintained in the system by the dust collecting equipment, with one collector for pitch dust and one for sea coal dust. The collectors may be operated in combination or independently.

Fig. 5. Large duct at left brings dust from several sources and delivers it to bagging machines. Dust is sold as separate product, as well as blended with other raw materials. Another large duct leads down from dust collector hopper at upper right to two smaller ducts. One at left takes dust to storage bin for further use, one at right delivers it to bagging machines.

Dust collection in the plant has both physical and economic purposes. Its primary purpose is to eliminate the hazard of spontaneous combustion of dust-saturated air. At the same time, collecting dust improves working conditions in the plant. On the economic side, the dust is a valuable product in itself. It may be bagged and sold separately, or, more generally, blended with the other raw materials to obtain end products with various characteristics.

All electrical equipment in the manufacturing and warehouse areas is explosion proof (Class II, Group F). All controls are interlocked to prevent an operator from starting or stopping the process equipment in the wrong se-

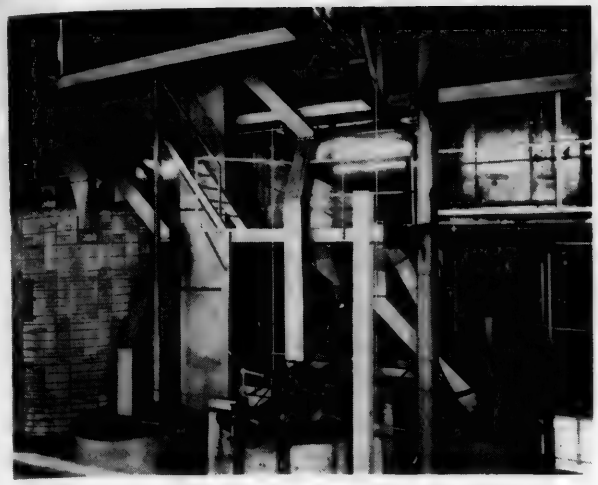


Fig. 6. Double-deck Link-Belt vibrating screens, totally enclosed and dust-tight, are shown above silo at left and in rear center. Centrifugal separator is in lower center, topped by motor and belt drive. Vertical circular duct runs from dust collecting hood over special products bin, lower left, to sea coal dust collector in upper right corner.

quence. Automatic magnetic separators are used to remove tramp iron from coal and/or pitch, thus protecting the process equipment from damage.

The selection of proper drives permitted the use of identical 75-hp, 1,800-rpm, explosion proof motors to power the pitch pulverizer, operating at 1,800 rpm, and two coal pulverizers, operating respectively at 1,200 and 3,600-rpm. Thus only one spare motor must be kept on hand, instead of the three normally required.

The manufacturing area is topped by six 70-foot H-

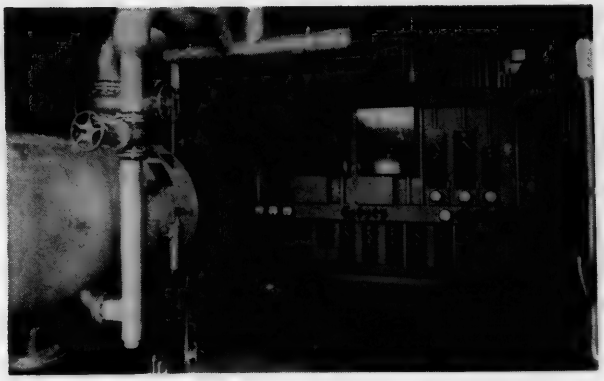


Fig. 7. Centralized and interlocked arrangement of electric motor controls and metering equipment located in the boiler room because there was thus no need for specifying explosion proof starters. All electrical equipment in the manufacturing and warehouse areas is explosion proof, however. Fifty-horsepower boiler at the left is oil or gas-fired.

section trusses, spaced 20 feet apart, running north and south. The space between the bare trusses is utilized for some of the processing equipment above the silos. The slightly peaked roof, sloped 3/8 inch to one foot, has a continuous ridge ventilator running east and west. Corrugated asbestos siding is used on all sides of the manufacturing area and on three sides of the warehouse area to the east.

A one-story wing on the west, faced north and west with brick, houses office space, toilet and locker facilities, and the boiler and control equipment room (Fig. 7). Rail lines bracket the plant, with incoming raw material being brought to a car shed and hopper on the north side and outgoing bags of foundry products leaving from the loading platform running along the south side.

Novel System Cools Guests In New Hotel

An unusual air conditioning system called for by unusual specifications for a revolutionary new hotel is keeping guests comfortable at the Lord De La Warr on the outskirts of Wilmington, Del.

Termed a motor hotel, the $1,250,000 De La Warr combines big city deluxe service with roadside motel convenience, according to Don A. Loftus, its builder. The hotel is the first completed unit of the $30,000,000 Five States Wonder Mile shopping center going up on 100 acres fronting the DuPont Parkway a mile south of Wilmington.

The air conditioning problem was posed by the unique plan of the hotel. The building group consists of four separate two-story units plus a central reception center building. Each unit has 36 rooms or suites, some with kitchen facilities.

Mr. Loftus set down the following specifications for the system: Every inch of interior space had to be air conditioned; liquefied petroleum gas was to be used throughout, and maximum silence and minimum use of space was required of all equipment. In addition, the installation had to be made with an eye to the over-all economy of construction of the buildings.

The problem was solved through the use of 37 Servel 2-ton Wonderair all-year gas air conditioning units, nine in each of the four buildings and one in the reception center.

The silent, no-moving-parts feature of the direct-fired absorption refrigeration system made it possible to install them in close proximity to the living quarters. In fact, they are fitted into the small utility closets of every fourth apartment. Each distributes conditioned air to four apartments through a small duct system. Each is operated by LP gas.

The supply ducts are of the normal construction used in any central air distributing system. However, the outside air intake and exhaust systems of this 100 per cent makeup air installation are uniquely incorporated in the floor construction of the second floors of the four buildings.

This floor construction, being of concrete and steel, makes it possible to use the spaces between joists as duct passages, with resulting savings in building costs. It is through these spaces that the two streams of air—the fresh air and the exhaust—are handled.

The installation was made by Schagrin Gas Co.

Mechanical Seals for Centrifugal Pumps

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Centrifugal Pump Division, Worthington Corp., Harrison, N. J.

Seventh in a series of independent articles about centrifugal pump construction and selection, this discussion of mechanical seals points out the uses of an important aid or substitute for conventional packing.

MECHANICAL seals were developed to seal rotating shafts as an alternate to the conventional stuffing box design packed with composition packing. In the conventional stuffing box, the sealing between the rotating shaft or shaft sleeve and the stationary portion of the box is accomplished by means of rings of packing forced between the two surfaces and held firmly in place by a stuffing box gland. The leakage around the shaft is controlled by tightening or loosening the gland stud nuts. The actual sealing surfaces which move relatively to each other are the axial surfaces of the shaft or shaft sleeve and of the packing.

When an attempt is made to reduce or eliminate all leakage through a conventional stuffing box, the gland pressure is increased. The packing, being semi-plastic in nature, forms more closely to the shaft and tends to cut down the leakage. After a certain point, however, the packing starts gripping the shaft as the gland nuts are brought up. The frictional horsepower increases rapidly at this point, the heat generated cannot be properly dissipated and the stuffing box fails to function. Even before this condition is reached, the shaft sleeve may become worn, scored or grooved and then it becomes impossible to pack the stuffing box satisfactorily. In other words, a certain amount of leakage is always necessary to lubricate and cool conventional packing. If leakage is severely curtailed or eliminated through over-tightening the gland, the packing will fail rapidly.

These characteristics make the use of a semi-plastic packing as a sealing medium undesirable if the leakage is to be held to an absolute minimum under severe pressure conditions. This, in turn, automatically eliminates the axial surfaces as the sealing surfaces, since a semi-plastic packing is the only material which can be made to form about the shaft, compensating for wear.

Another factor which makes stuffing boxes unsatisfactory in certain applications is that many liquids, frequently handled today by centrifugal pumps, such as propane or butane, have relatively little lubricating value and actually act as solvents of the lubricants normally used to impregnate the packing. Such services require that seal oil be introduced into the lantern gland of a packed box so as to lubricate the packing and give it reasonable life.

With these facts in mind, mechanical seal designers have had to develop an entirely different form of seal, using wearing surfaces other than the axial surfaces of the shaft and of the packing.

All mechanical seals, while they differ in various physical respects, are fundamentally the same in principle. In each one, the sealing surfaces are located in a plane perpendicular to the shaft and usually consist of two highly polished surfaces running adjacently, one surface being connected to the shaft and the other to the stationary portion of the pump.

Complete sealing is accomplished as the fixed members. The polished or lapped surfaces are of dissimilar materials and are held in continual contact by a spring. They form a fluid tight seal between the rotating and stationary members with very small frictional losses. When the seal is new, the leakage past the mechanical seal is so small as to be negligible and can actually be considered as non-existent. Of course, some wear occurs and provision must be made for a very small amount of leakage.

The wide variation in seal design stems from the methods used to provide flexibility, and to mount the seals. A mechanical seal is similar to a bearing in that it is a close running clearance with a liquid film between the faces. This film provides some lubrication and cooling which, together with a proper choice of seal face materials, results in very little wear. Seals for centrifugal pumps do not operate satisfactorily on air or gas, and if run dry, they will fail rapidly. Seals can be used in pumps handling liquids which contain solids, as long as provision is made to prevent the solids from getting between the seal faces or interfering with the flexibility of the mounting.

To obtain the pressure breakdown between the internal pressure and the atmospheric pressure outside the pump requires a flow of liquid past the seal faces. This flow, which manifests itself as leakage, may be only a drop every few minutes, or even a haze of escaping vapor (when handling a liquid such as propane, for instance). Thus, even though the leakage is negligible, technically

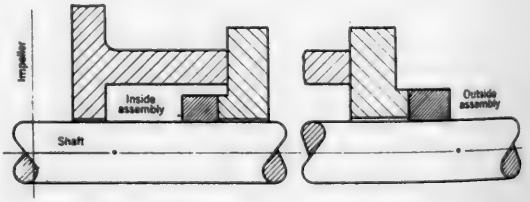


Fig. 1. Basic seal arrangements.

speaking a rotating mechanical seal cannot *entirely* eliminate leakage.

Figure 1 shows two basic seal arrangements, which differ in relation to the location of the mechanical seal. The internal assembly is one where the rotating element is located inside the box and is in contact with the liquid being pumped. When the rotating element is located out of the box, the seal is an outside arrangement. The pressure of the liquid in the pump tends to force the rotating and stationary faces together with the inside assembly and to force them apart in the external assembly.

The operation of a mechanical seal can best be understood by reference to a few standard commercial units and the following discussion treats of the general characteristics of several of the most successful types of mechanical seals. It should be borne in mind, however, that as every pumping problem is different, so is every sealing problem and when positive and dependable results are desired, the mechanical seal should be specifically designed and fitted to the particular unit in question.

The construction of a typical seal is illustrated in Fig. 2. The gland with the gland insert are fitted into the casing and this group is the stationary member of the seal assembly. It provides a seal at two points: first, by means of the gaskets between the gland and the face of the stuffing box and second, through the contact between the gland insert and the seal ring face. The mating seal ring with a hardened steel surface rotates with the shaft and is held against the stationary member by the compression ring. The latter supports a nest of springs which are connected at the opposite end to the collar which, in turn, is fixed to the shaft. The seal ring is fitted with packing in the shape of an O-ring, which prevents all leakage between the seal ring and the shaft. It is essential in such a seal that one face be flexibly mounted so as to keep the surfaces in full contact with reasonable shaft deflection. The springs and an ample clearance between the shaft and the seal ring proper accomplish this in the unit illustrated. At the same time, the collar keeps all the other rotating members of the seal in proper position.

The gland insert which is in contact with the seal ring is made of anti-frictional material. It can, when necessary, be designed for lubrication by a liquid other than the liquid pumped.

Two such seals may be mounted inside a stuffing box

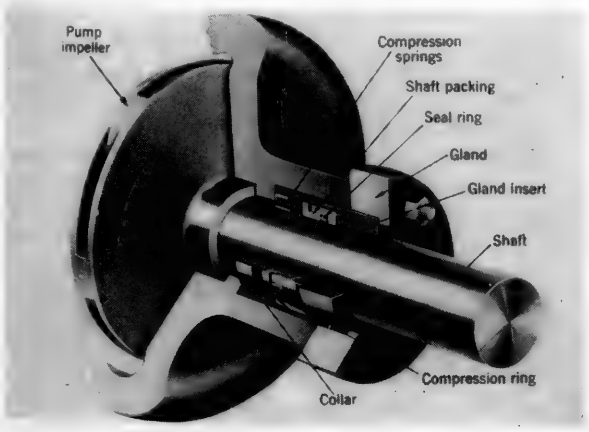


Fig. 2. Dura-Seal mechanical seal.

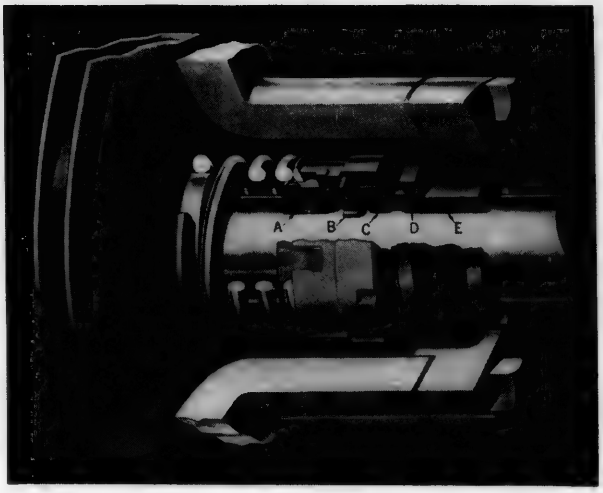


Fig. 3. John Crane mechanical seal (rubber bellows type).

to make a double seal assembly. Such an arrangement is frequently used for sealing centrifugal pumps handling abrasive, extremely corrosive or dangerous liquids. It may also be used when the pump handles liquids at very high or extremely low temperatures. A cooling liquid is supplied between the two seals at a pressure higher than at the interior of the pump adjacent to the first seal. Typical of the spring loaded, synthetic rubber bellows type of mechanical seal, is the seal illustrated in Fig. 3. The tail of the synthetic rubber bellow (A) seals on the shaft; the head is flexible and adjusts automatically for washer wear and shaft end play. The protective ferrule (B) prevents the flexing area of the bellows from sticking to the shaft. The sealing washer (C) has a positive drive through metal parts and seals against the stationary floating seat (E). The two sealing faces (D) are lapped at the factory and provide a seal against leakage.

For extremely high or extremely low temperature applications (as, for instance, the circulation of very low temperature refrigerant), the bellows seal is not satisfactory and a Teflon type seal is manufactured for this type of service. It is illustrated on Fig. 4. The metal retainer which is locked to the shaft by set screws (A) provides a positive drive from the shaft to the carbon

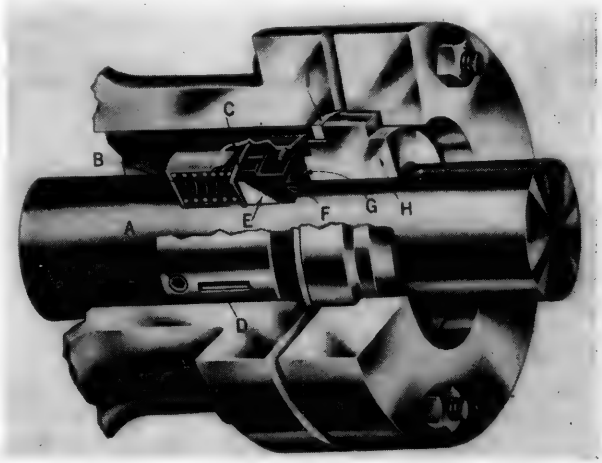


Fig. 4. John Crane mechanical seal (Teflon type).

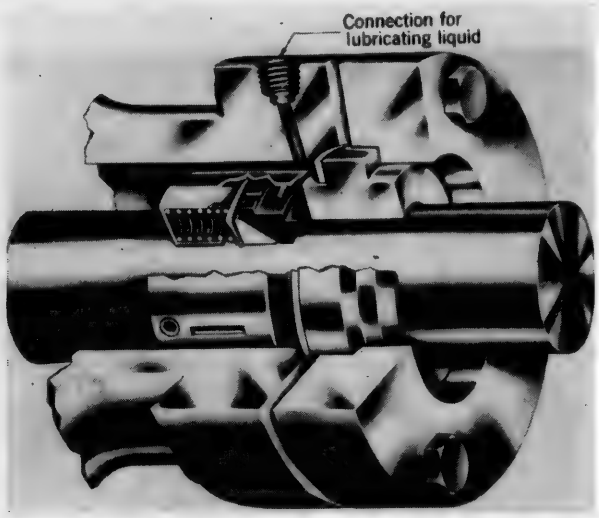


Fig. 5. John Crane mechanical seal (Teflon type) with a connection for liquid lubrication of seal faces.

sealing washer (F) through dents (D) which fit into corresponding washer grooves. The seal between the shaft and the washer is insured by the Teflon wedge ring (E) which is preloaded by the action of multiple springs (B). The spring pressure is uniformly distributed by a metal disc (C). The lapped raised face of the rotating sealing washer mates against the precision lapped face (G) of the stationary seat (H) to provide a positive leak-proof seal with minimum running friction between the faces. The spring pressure keps the faces in constant contact, providing automatic adjustment for wear and shaft end play. A Teflon ring (I) acts as a static seal between the stationary seat and the end play.

When applied to pumps on vacuum service or operating with a high suction lift, a supply of lubricating liquid is forced through a connection, as shown in Fig. 5. If the liquid pumped is clear this tap can be connected to the discharge of the pump.

A number of pump manufacturers have lines of single stage end suction pumps which can be equipped with mechanical seals instead of conventional packing. In many cases, such seals are offered as a standard alternate construction and can be applied to the pumps without any change in machining. A few manufacturers build some sizes of standard pumps with mechanical seals only, but such a practice makes these pumps less flexible as a line.

Actually, the substitution of mechanical seals for packed stuffing boxes is not always an unmixed blessing and, for some services, the mechanical seal is not as desirable as packing. These services include conditions where the liquid pumped tends to form crystals on changes of temperature or on settling. Another condition which is not propitious for the application of mechanical seals is a service where a pump has long idle periods, when it may even be drained. The flexible materials used in the seal may harden or slight rust may form, either of which could cause the seal to stick and damage it on restarting. Finally, mechanical seals are still subject to failure on occasion and such a failure may be more rapid than that of conventional packing. If packing fails, the pump can generally be kept running by means of temporary adjustment until it is convenient to shut it down. If a mechanical seal fails, the pump must be shut down at once.

Proper application of a mechanical seal is extremely important. Cooling of the seal faces is important for satisfactory seal life and a seal installed inside a pump without a suitably directed flow of liquid for cooling and flushing (to prevent solid material from settling on the springs, for instance) may have an unsatisfactory life.

The mechanical seal has its place in the application of centrifugal pumps, as it will, when properly applied, effectively prevent stuffing box leakage.

Next month, the authors will take up the subject of centrifugal pump bearings.

Ice Rink Piping Survey

Piping in ice rinks, if properly installed and maintained, is giving long dependable service, a recent survey reveals. Corrosion, once a bugaboo to rink owners, seems to be under control. Piping installed 20 or more years ago is still giving satisfactory service. A majority of the installations reported were of steel pipe, followed closely by wrought iron pipe, both of which showed long service.

Most of the pipe used is of either 1¼-inch or 1-inch diameter. A separation of 4 inches between centers is used in half of the rinks that submitted reports, with the separations in other cases ranging from 2 inches to 8 inches.

In all but a few cases, the lengths of pipe are welded together, rather than being attached by threads and couplings. Most of the pipe is uncoated. Brine is overwhelmingly favored over ammonia and other refrigerants. In most cases a corrosion inhibitor is used in the brine.

This information was brought to light by questionnaires mailed to owners or managers of all United States and Canadian rinks with artificial ice installations, other than small studio rinks. Detailed replies were received from 52 U. S. rinks and 60 Canadian rinks, including a number of the largest in each country.

In the United States, 28 rink managers reported using steel pipe, with the earliest installation still in use dating back to 1923, and 19 reported using wrought iron pipe, with the earliest installation still in use dating to 1936. In Canada, 31 reported using steel pipe, with the earliest installation still in use dating back to 1929, and 23 reported using wrought iron pipe, with the earliest installation still in use dating to 1931.

The greatest variation indicated in both countries is in the types of bases used. These range from simple installations, with the pipe resting on sleepers and covered by sand, to those using a variety of materials in layers.

Concrete is used in one way or another in the bases of more than half of the United States rinks, but only about one quarter of the Canadian rinks. Sand, with or without other materials, is used by more than half of the Canadian rinks. Other materials used in both countries include cork, cinders, gravel, crushed stone, and asphalt.

The survey was conducted for the Spang-Chalfant Division of The National Supply Co., whose Spang steel pipe is used in a number of United States ice rinks, in order to obtain information that might help each rink get the maximum service from the pipe used.

Louis Blendermann on

PIPING and PLUMBING

How to Install Drainage Piping in Fill

MANY of the new buildings now under construction, designed for varied occupancies, will not be equipped with basements or cellars. Instead, the first floor of the building will set on the grade level. This means that all the mechanical and electrical equipment, distribution piping and services will be installed within the area of the first floor. This form of construction is rather widely used and is very often found in the new single story, rambling type of school buildings and in single story industrial plants.

When buildings of this type are contemplated, the architect carefully studies the contours of the ground at the proposed site to select the location in which the building, when it is erected, will be prominent with regard to elevation and attractive appearance.

To achieve these desirable features, it is often necessary to either remove some of the existing grade or to add the fill necessary for the proposed elevation requirements of the building.

In this article, we are concerned with the situation that requires the addition of fill. When fill is involved, careful study must be given to the support of the sanitary and storm drainage piping that will be installed in the ground, under the first floor slab. Depth of the required fill often ranges from several inches to a good number of feet. If this fill had sufficient time to compact, there would be no problem relative to the installation of drainage piping. Since footings or piles are extended down to the existing hard, compacted earth, the construction work of the building itself is not dependant upon the stability of the fill. Grade beams are supported on these footings.

However, drainage lines must be installed before the floor slab is poured and very often at the time these lines are installed, the fill may not have had enough time to compact. As a result, there is the ever-present danger that the piping will settle and fracture so that leaks will occur. When sanitary or storm water lines leak under a building, the resulting damage can be considerable. Most unfortunate is the fact that after the slab is poured, the piping is inaccessible and therefore cannot be repaired or replaced without the expense of chopping up the slab. An illustration of what can happen when piping is installed in fill is shown in Fig. 1.

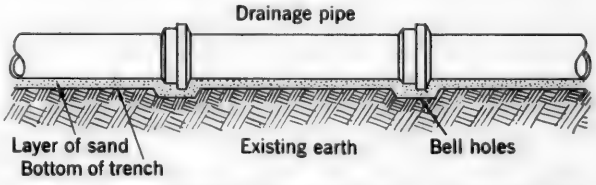


Fig. 2. Piping installed in existing earth or compacted fill.

Compacted Soil

Where natural soil or compacted fill exists, the piping installation is made in a manner similar to that shown in Fig. 2.

In this detail it will be noted that the trench must be carefully graded and bell holes cut in the earth to allow

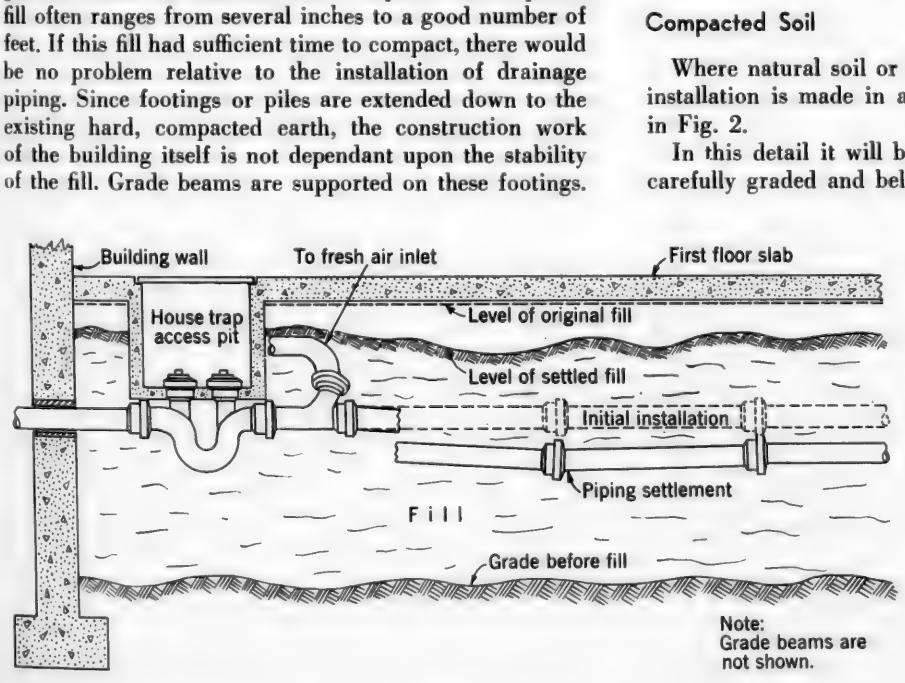


Fig. 1. What happens when piping is installed in loose fill. Dotted lines show initial installation.

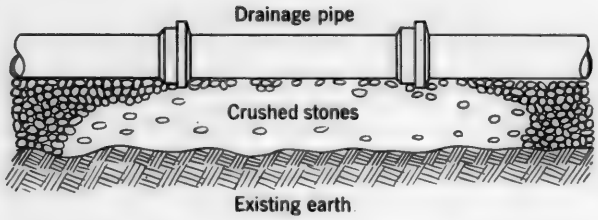


Fig. 3. Piping installed in shallow fill.

for an even distribution of support for the piping. A thin layer of sand is placed under the piping because sand is easily compacted under the weight of the pipe. This sand furnishes a soft bed into which the pipe will so settle and it will be firmly supported for its entire length.

If the backfilling of the trench is carefully handled, the installation can be counted upon for long service and free of the leaks or breakage that follows pipe sagging.

Shallow Fill

Where shallow amounts of fill are encountered, piping may be installed as shown in Fig. 3.

Here the trench is excavated down to the existing earth and is backfilled to the proper elevation for the piping with crushed stone or similar material that is easily compacted. By these means a firm bed may be obtained for support of the pipe. Here again, if the final backfill is carefully handled, the piping system may be considered well installed.

Deep Fill

It takes time for fill to compact enough to support piping. Although this settling can be speeded by physical means, this is seldom done to any extent. The building construction often proceeds shortly after the fill has been applied so that there is not enough time for compacting the fill. Therefore, to protect the drainage piping, special supporting means must be considered. Although there are numerous methods, a few that adequately serve the purpose will be described. One such method is shown in Fig. 4.

Piping Support

With this method, the pipe is supported from the slab itself. Piping is installed in the trench after the grade beams have been formed, poured and set. A pipe clamp is fastened to the pipe, with the hanger rod and plate set in a vertical position. The hanger rods are wired to the reinforcing rods that have been set in place for the pouring of the floor slab. The plate is so arranged that it will be flush with the top of the rough slab to be later concealed by the finished layer of cement, as indicated. If a finished cement layer is not contemplated, the plate is then placed as a part of the slab itself. However, this method of support should first be discussed with the structural engineer to be certain that the slab can carry the weight load of the piping.

Another practical method is to support the piping from the grade beams as illustrated by Fig. 5.

Inserts are set in the forms used for the grade beams, before the concrete is poured. Later when the piping is installed, it is an easy matter to fasten the hanger rods to the angle supports as shown. However, the grade beams are seldom spaced close enough to provide sufficient supports for the cast iron piping. As a remedy, intermediate piping or structural supports are placed between the grade beams, to which the piping may be attached.

If very large diameter pipe is to be supported, piles may be utilized, in a manner shown in Fig. 6.

Piles are driven down into the hard natural earth to assure a sturdy support for the piping. Piers of concrete or cement blocks set on footings may also be used for the support of the piping.

Screwed Piping

Drawings with this article have shown the methods that can be used to support pipe in fill. Cast iron pipe in 5-foot lengths was shown in these illustrations because it is the material most generally used for sanitary and storm water lines installed in the ground under a building. However, at this point it is recommended that when fill is encountered, cast iron pipe in long lengths with screwed or regular ends be used and material other than cast iron also be considered. A suggested material is galvanized wrought iron pipe or pipe with the same durability. The advantage in using galvanized wrought iron piping is that the pipe comes in long lengths with piping connections of threaded galvanized cast iron and recessed type drainage fittings.

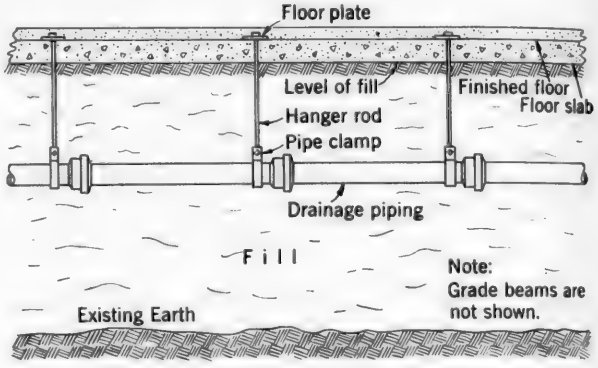


Fig. 4. A method of supporting pipe from slab by means of hangers.

These long length pipes provide a system that is more rigid than one made up of 5 ft lengths of bell and spigot

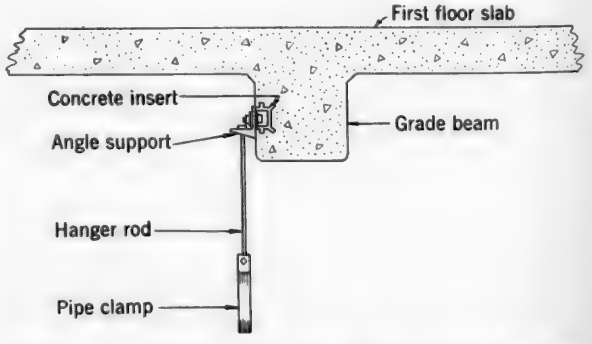


Fig. 5. Typical arrangement for the support of piping from grade beams.

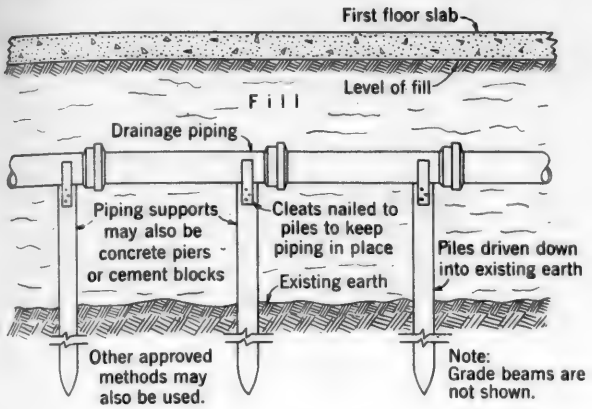

First floor slab
Level of fill
Fill
Drainage piping
Piping supports may also be concrete piers or cement blocks
Cleats nailed to piles to keep piping in place
Existing earth
Piles driven down into existing earth
Other approved methods may also be used.
Note: Grade beams are not shown.

Fig. 6. Piping supported on piles or piers.

cast iron pipe and fewer hangers or supports are required. The wrought iron pipe can be supported every 10 to 12 ft rather than every 5 ft as required for cast iron. In addition, the wrought iron pipe will withstand the action of the fill as readily as the cast iron pipe. If desired, the pipe manufacturer can be consulted to determine the corrosive properties of the fill so that he can specify the protective coating that should be applied to the pipe exterior to assure long and durable service. Moreover, wrought iron pipe can be supported in the fill by the same means as detailed in these illustrations, except that fewer hangers or supports will be required.

Engineer's Concern

If fill is contemplated for a proposed project, then the engineer must decide how the piping is to be supported, and whether this method be detailed by drawings or covered in the specifications.

If the fill has had, say, six months to compact, then piping supports are not necessary. If the fill has been firmly compacted by approved physical methods, then again supports may not be required. However, when physical means are employed, the compactness of the fill should be guaranteed by the contractor.

If it is known that the fill will not have had sufficient time to compact by the time the drainage piping work proceeds, then details showing the proper supporting methods to be used should be included in the contract drawings.

And should the project be of a nature that, during construction, there will be doubts concerning the compactness of the fill or the amounts of fill to be added, then the engineer should cover the subject of special supports for the pipe in his specifications. There can also be a provision in the specifications requesting the contractor to submit drawings for approval, which show methods he intends to use for the piping support, if fill is involved.

In any event when fill is encountered, every possible precaution should be taken relative to the proper installation of the drainage piping to assure a permanent system.

Correction to November Article

On page 112 under the subhead "Limitation of Supply," the sentence should read, "This would use an indirect heater with the highest rated capacity of 600 gal per 3-hour period." It was erroneously given as 500. On page 113, second column, line 1 should read, "temperature of the water in the storage tank drops *below* the desired value."

Hotel Installs Central Control System

A project which has been in progress for more than two years, has been completed with the placing in operation of a master board in the office of Building Superintendent Thomas J. Barrett on the seventh floor of The Waldorf-Astoria, New York City.

Mr. Barrett, with the assistance of Chief Engineer Richard Butler and Maintenance Director William T. Ferguson, has carried out the plans for the master board system, through which heating and air conditioning in all parts of the hotel may be centrally directed.

A part of this system which was rushed to completion in advance of the general installation, that which covers the Grand Ballroom, was dramatically brought to attention last Spring when it was used for the first time during the General Motors Motorama extravaganza. Despite the great crowds in the ballroom the air was kept constantly clear and fresh, at a comfortable temperature, and free from a smoke overhang which is difficult to eradicate in crowded enclosed areas.

In regulating the entire building, 48 areas were established. Temperatures in these zones are registered on separate thermometers on the master board. Desired levels may be set for automatic control and functioning of the system may be checked and corrected from the seventh floor core.

The board is under supervision 24 hours daily. A small green light over zone indicators reveals desired temperatures are being maintained. When the automative devices correct a defection, a red light shows on the board. The attendant watches this to make sure that the corrective machines are functioning until the green light again flashes on. The board also registers temperatures on charts providing a record of all zones on an around-the-clock basis.

The establishment of the controls in Mr. Barrett's office has been found greatly to expedite the rectifying of guest requests, which sometimes reach more than 100 per day.

Electric current supervision is also directed through new equipment from Mr. Barrett's office with both alternating and direct current in use in the hotel. The demands on each of these may be read on indicators and when electric loads in special parts of the building are shown, it is possible to rectify and properly distribute the current flow from the central point. This function had previously been operated from a separate unit in the basement.

Coordination of the electric system into the other functions of the Building Superintendent's office has led to a speeding up of service and to economy in operation.

LONDON LETTER

Commentary on developments in Europe by our correspondent in Great Britain

IMMUNIZATION is not only to be bought by the jab of a needle. Doctors and nurses do not regularly catch the diseases of their patients. Your Correspondent, when a small child, was taken on visiting 'rounds' in the parental automobile. At first there was an understandable curiosity to see the doctor's new baby, but it was a good idea and was encouraged. Into the house went the doctor, and shortly there came out a friend or relative or two to exchange ideas and germs with the doctor's progeny waiting in the auto. This was held to be excellent education for the child's brain and for its antibodies.

As for the brain, no comment, and whether this procedure immunized the child to any extent is a moot point; but at least it got rid of the patient's relatives.

Germicidal Lamps

Ever since Pasteur discovered germs and Lister discovered antiseptics, man seems to have had a growing passion to live without bacteria. Clean wrapped food; antiseptic detergents for washing up; sterilized milk; chlorinated water supplies; and now he even wants germ-free air to breathe on the grounds that he uses ten times as much (by weight) air as water. He must not be surprised after all this if he goes down badly with some virus disease he has had no practice against, and then has to develop a new vaccine. Provided this is accepted, it is very reasonable to want to kill off airborne bacteria, because a few of the thousands of types are actually harmful. One way of doing it is by means of ultra-violet light. The French journal *Chauffage, Ventilation, Conditionnement* devoted the greater part of its January and February, 1952, numbers to an article by R. C. Geslin on this subject. Apparently there are several successful installations in France.

There are five principal effects of ultra-violet light. It produces Vitamin D from ergosterol in the skin, it causes erythema or pigmentation of the skin, it coagulates albumen, it sterilizes bacteria, and it produces ozone from oxygen in the air. But all these effects are not produced by the same wavelength of ultra-violet light. It is the light just above the visible blue or violet region that causes the tanning of the skin in search of which ladies regularly visit Southern resorts (or the local drugstore); a slight overdose of ultra-violet in the 3500 Angstrom region, and the drugstore is visited for sunburn instead of suntan lotion. 3000 A radiation very quickly inflames the skin. Radiation of 1850 A wavelength produces ozone, a form of oxygen which, like so many other things (e.g., arsenic, water, lettuce, prussic acid, whiskey, rest, and exercise) is harmless and even beneficial in small quantities, but poisonous if you have too much of it.

Mercury vapor lamps for sterilizing bacteria are constructed with glass which has good transparency for radiation around 2537 A, which is the principal emission from the mercury vapor, but does not pass much of the ozone-producing shorter wavelengths. Radiation in this intermediate range is, fortunately, the most effective against bacteria. It is not necessary to give each bacterium an internal suntan sufficient to kill it outright. Coagulation of some albumen or damage to a few nuclear proteins will be enough to upset the reproductive mechanism so that the bacterium is sterilized and unable to multiply in the human body.

There are three principal ways in which the lamps are used. They may be placed at doorways to prevent passage of bacteria, the very small dose received by human beings on their way through being harmless. Rooms which are used intermittently may have the air sterilized before the entry of people, or the lamps may be placed in the ventilating ducts; in either case lamps and humans are not in the same place at the same time. A third way is to install the lamps with their radiation kept above eye level by means of aluminum reflectors and ultra-violet absorbing paints; natural circulation of the air is relied upon to waft all the bacteria up into the lethal zone between human heads and the ceiling of the room.

Do They Do Any Good?

Installations on the lines of the last-mentioned system have been made at some London schools, and very careful records kept to find out whether the lamps had any beneficial effect on the absences due to illness of schoolchildren.

The investigation was made in 6 of the 7 primary (ages 5 to 11) schools in the borough of Southall, an urban area about 8 miles to the West of the center of London. With canals on two sides of the triangular region and the open ground of two golf clubs on the third, this borough is more self-contained than most. The seventh school was well away from the other six, at the extreme northern tip of the region, and it was omitted. The children were taught in classes of 30 to 40 and for the most part had all their lessons in their own classroom, attending school from 9 till 12 and from 1:30 to 3:30 or 4 p.m., Mondays to Fridays. Lamps were installed in three of the schools,

and it had been intended to put "dummy" lamps in the other three which were to serve as controls, but this could not be done because two of these had no electrical supply.

The school teachers kept a careful record of outages of lamps and of children. Lamps were replaced as soon as practicable, and on less than 2% of the days in any classroom was there a lamp not working. In the junior mixed department of one school, heated with open fires and lit by gas, the lamps were cleaned fortnightly; monthly elsewhere. The reasons for each absence (1 day or more) of each child were gone into thoroughly, with a medical certificate or an actual visit to the child's home when necessary.

A routine of visiting the schools for the purpose of measuring ventilation, temperature and humidity, and for taking bacteriological samples, was established. Four rooms in two schools (one irradiated and one control) were visited each day, each room being visited about once a month, but in random order. During the first of the nine terms during which this investigation lasted the activities of the team of testers attracted considerable attention, but the novelty soon wore off. With improved sampling equipment (described in an appendix to the published report) two observers instead of three could make all the tests. Temperatures and humidity were measured near the center of the room. The air sample for bacteriological testing was taken about 3 ft from floor level, at least 6 ft from the mouth of the nearest child.

The ventilation rate and the circulation time of the air in the room were measured by liberating acetyl acetone and observing its rate of disappearance through dilution with fresh air from outside the room. The number of air changes per hour varied between 5 and 10, the circulation time was around 100 seconds, the air temperature (dry bulb) about 66 deg F, the relative humidity 52%; all these are averages of several readings for each classroom. They show the classrooms did not differ much from each other. The averages by term varied, for example, from 60 deg F dry bulb in the spring of 1947 to as high as 70.5 deg in the second term. Since in February, 1947, we had the freeze-up and the fuel crisis there were probably some days with temperatures somewhat below the average of 60 deg. Depending on which day summer occurred that year there might also have been a day or two much warmer than 70.5 deg.

A classroom in an irradiated school in Great Britain. *A* and *B* are the two fittings, each with a 30-watt ultra-violet lamp and *C* is an integrating meter for ultra-violet intensity measurements. The windows seen provide cross-ventilation; the principal windows are situated to the right. Photo, British Crown copyright.

Tables of comparisons in all kinds of ways, such as floor area per child, activity during class, etc., show that the three control schools were very similar to the irradiated (except for those open fires and lack of electricity). The results of measurements show that on average the bacterial counts were significantly less in the schools with ultra-violet lamps. The general aerobic flora were reduced to 83% in the irradiated schools (55 colonies per cu ft instead of 66 in the controls); total streptococci were reduced to 41%, and one particular organism, *Str. salivarius*, was reduced to 27%. There were some trends with time which have given the statisticians a few headaches in interpretation. Indeed so many data have been accumulated and so much work has been put into their correlation that although the tests were made in 1947 through 1949 the report was only completed in May, this year, and published a few weeks ago. It is Special Report No. 283 by the Medical Research Council, entitled "Air Disinfection with Ultra-Violet Irradiation" and obtainable from British Information Services, 30 Rockefeller Plaza, New York 20, N. Y. Price, $1.60. The accompanying photograph, taken from the report, shows one of the classrooms, with ultra-violet lamps and ultra-violet intensity meter.

Of course, it is easy enough to find excuses. The children spent only 25% of their time at school and played with their classmates at home; if a child is going to get measles it will get it some time, and so on. But the plain fact of the matter is that there was no difference in absences. One could not even say that a reduction in absences due to disease was balanced by an increase due to accidents. When the absences were considered in such detail, however, it seemed that among the infants classes diseases like mumps went around more slowly in the irradiated schools. Indeed, if this work proves to everybody's satisfaction that ultra-violet lamps are not worth installing in schools it has at least had the positive result of shedding useful light on the rate at which diseases are spread.

Health in Industry

The Swiss journal *Heizung und Luftung* contains in its latest issue a description by Wilhelm Zimmermann of Berlin of one of the most complicated heating, ventilating and air-conditioning jobs ever. It is a Baths and Health Center for employees of the German State Railways at Kassel. All the heating is taken from a high-pressure hot-water system supplying at 300 deg F, although there are emergency boilers. The heat is taken from the mains by a heat-exchanger and a heat reservoir for the swimming-bath, into a low-pressure, warm-water system for general room heating (panels and conditioned air), and without a heat-exchanger for some radiators working at the full

(*Concluded on page* 152)

What Would You Do?

Replies to engineering and operating problems of interest to the industrial plant engineer

Conducted by
NATHAN N. WOLPERT
Associate Editor

NOISE resulting from the operation of a large fan or blower has always been a problem to the operators of ventilation or air conditioning systems. The current discussion is based on a problem relating to the operation of an air conditioning system.

Should you have a problem that you would like to see discussed in this department, or if you have comments that you would like to add to next month's discussion, please write to the Editor.

This Month's Problem

Part of a large floor at our plant is to be walled off and partitioned into offices. Across the corridor from one of the offices will be the room in which will be a large centrifugal fan, filters and coils of an air conditioning system. Fears have been expressed that fan noises will be communicated to nearby offices. Are there any rules to follow, either in fan selection or installation, that will reduce or eliminate the noise hazard?

Discussions

The amount of noise that a fan makes in operation is governed by several factors such as type of fan, fan efficiency, the static pressure that the fan must work against, mounting, and reverberation of the system.

When selecting a fan for the most quiet operation, select the most efficient fan of a given type that will meet the capacity requirements. Selection of fans according to efficiency is simplified in some fan manufacturers rating tables. For instance, the most efficient fan that will give satisfactory results will have the lowest outlet velocity of this type.

Outlet velocity and tip speeds are sometimes used as guides to quiet operation. However, these values do nothing more than keep the selection of a given fan in the higher efficiency zone.

High static pressures and high fan noise go hand in hand. A fan must run at a relatively high speed in order to deliver a given volume of air against higher static pressures. And higher speeds result in higher noise levels. Thus, if the most efficient fan that you can select is still too noisy, it may be necessary to redesign the system. If acoustical insulation and distance from the fan to the outlets have been utilized to the maximum, the only way to lower the noise level is to redesign the system for lower resistance.

The subject of sound and the noise produced by fans is a large and complex one. However, there are certain factors that must be considered if the fan installation must be successful. The first of these factors is the noise level of the fan itself. The noise that we are concerned with is that of the air stream in the fan discharge. Fan noise, as determined in accordance with the National Association of Fan Manufacturers' code, is measured only in the space around the fan—not in the discharge. The noise in the fan discharge is somewhat greater than these coded ratings. Experts disagree on the exact amount, but it will be from 10 to 20 decibels greater. Any calculations of fan noise levels should be used only with extreme caution.

The next sound factor to be considered is that of attenuation in ducts. Therefore, the fan and motor would be mounted on an isolating base, and canvas connections used between the ducts and fans.

If the system designed is too noisy, two solutions can be considered:

1. Static pressure (resistance) of the system can be reduced to decrease the fan sound level.
2. Discharge ducts can be acoustically treated.

Reduction of the fan static pressure requirements can entail a complete redesign of the whole system. In this case, the simplest and most economical solution would be to line the duct with acoustical insulation. Data given in source literature can be used to determine the amount of lining and baffling necessary for the particular requirements of the system.

Here are four outstanding facts that can serve as useful tools in the selecting of centrifugal fans for any system.

1. The fan selection for any given job cannot be based entirely on outlet velocity or tip speed. The minimum outlet velocity and tip speed that can be used depends on the static pressure that the fan must develop.

Problem for the Next Issue

I would appreciate any information regarding a chemical or additive which can be added to the water line in a building which serves drinking and lavatory fixtures, which will inhibit rust, stop the corrosive action, and seal off any pin holes that are about to form in an old galvanized pipe water line. Lots of these pipes are in concrete and cannot be replaced without great expense. The same condition exists with the steam lines of black iron pipe in the heating system of this building. I am wondering if such a chemical could also be used successfully in the steam line.

2. Savings in first cost should be checked against operating costs in making any final selection. Often, a more expensive fan installation will pay for itself in lower operating costs within a short period of time.
3. A fan is generally noisier when it operates against a high static pressure than when it delivers the same air volume against a lower static pressure.
4. Generally, fans operating at high efficiency are quieter than the same type of fans with a low efficiency. For the most quiet operation, select the most efficient fan. If this fan is still not quiet enough after the system has been treated, the only alternative is to redesign the system for a lower static pressure.

R. G. Lubinsky
Manager, Fan Sales Dept.
The Trane Co.

La Crosse, Wis.

The best solution is to change the location of the fan room. Assuming, however, that this is impossible, there are several ground rules for equipment selection and application for quietness of operation.

The basic system should be designed for minimum pressure loss and low velocities. The higher the pressure against which the fan will operate, the higher will be the noise level, and a well designed low velocity system will be inherently quiet itself.

The fan should be selected for peak efficiency or as close as possible to this point. This will contribute to quietness of operation in two ways. Air noise caused by turbulence is at a minimum at peak efficiency and also the pressure characteristics of centrifugal fans are such that close to the lowest peripheral velociy for a given pressure is obtainable at maximum efficiency.

Some form of acoustical treatment will in all probability be necessary to absorb fan and air noise so that it will not be carried through the duct work. Regardless of fan type or blading, the noise absorbing material should be designed to remove the noise in the 50 to 100 cycle frequency band to the necessary degree. Recent tests have shown that the loudest fan noises occur in this frequency range and the noise in other frequencies will automatically be absorbed to an equal or greater degree.

The fan and motor should be isolated from the building steel and duct work. A heavy poured concrete foundation is desirable with the fan mounted on a vibration isolating base. Flexible connections should be used between the fan and duct work.

Sound insulation will probably be required between the equipment room and adjacent offices. Dense, solid materials such as steel or poured concrete are best for sound insulation as contrasted with the light porous materials used for sound absorption. Be sure that solid, well fitting doors are used. Any cracks or openings can nullify the effect of an expensive wall.

The proper balance of these various factors depends, of course, upon the individual problem and no set of rules will apply in all cases. It is obvious that if the fan and system are sufficiently quiet, little accoustical treatment is required. On the other hand, space or specific design conditions may exist that contribute to the selection of noisier equipment, in which case more elaborate sound absorption and insulation may be required

It is well worthwhile, in most conditions, to use the services of a consulting engineer who is familiar with all of the aspects of such a problem and who can recommend the most economical solution.

A. N. Rogers,
General Purpose Fan Section
Westinghouse Electric Corp.
Sturtevant Division

Hyde Park, Mass.

Previous Month's Problem

The following comments are in reference to a previous problem regarding the water demand for various plumbing fixtures installed in a factory.

In answer to the question regarding water demand for plumbing fixtures for factory use, rates of flow are as follows:

TABLE 1.—FLOW FROM FIXTURES

Fixture	Flow, GPM
Water Closets	
Wash down closet	27 to 33
Siphon jet closet	30
Urinals	
Wall—blowout	24
Wall—washout	20
Stall	15
Pedestal*	45
Lavatories—1 ¼-inch outlet	7.5
Sinks—1 ½-inch outlet	11.3
Service sinks—3-inch outlet**	12
Shower heads	
Single—4-inch size, ½-inch inlet	6
Single—6-inch size, ½ inch inlet	12
Wash fountains	
36-inch circular	5
36-inch semi-circular	5
54-inch circular	7.9
54-inch semi-circular	5
Showers	
Circular—5-compartment per shower head	¾
Semi-circular—3-compartment per shower head	¾

*Not generally used in industrial buildings.
**Service sinks can be omitted from the computations of sizes of water supply and drainage lines because they are in use when washrooms are otherwise unoccupied.

The maximum possible percentages of use for various rates of flow (mixed systems with flush valves and ordinary fixtures) are given in Table 2.

TABLE 2.—POSSIBLE PERCENTAGE OF USE

Max. Possible Flow, GPM	Max. Possible Percentage of Use
90 and below	100
100	93
200	55
300	40
400	32
600	24.5
800	21
1000	19.7
2000	15.9
5000	12.6

Stanley H. Smith, Jr.,
Utilities Design Engineer,
Carbide and Carbon Chemicals Company
South Charleston, W. Va.

NEWS OF EQUIPMENT AND MATERIALS

Use the handy prepaid postcard, page 122, for securing additional information on items described in this department.

Shaft-Mounted FHP Motor

A totally enclosed fractional horsepower motor for shaft-mounted fans and blowers, weighing 50% less than previous models, has been developed by General Purpose Component Motor Dept., General Electric Co., Schenectady, N. Y.

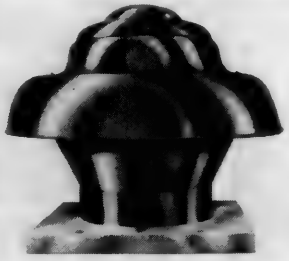
The manufacturer states that the light weight and small size of the new motor save assembly and handling expense, and provide maximum power in minimum space. The design has extended through-bolts which provide a solid mounting face beyond the surface of the end shield. Resilient rings on bearing housings, and optional resilient base, make possible a wide variety of mounting arrangements.

The single- and two-speed, totally-enclosed, fan-cooled, shaft-mounted fan and blower motor is designed for continuous service under severe conditions of dust and dirt. Filtered oil keeps the bearing surfaces clean in the quiet all-angle sleeve bearings. The motor has an extended oiler on the shaft end. Designed for applications having moderate thrust, the motor is available in one- and two-speed single-phase models, and in single-speed polyphase models, with ratings up to ½ hp. Ball bearings are available for heavy-thrust applications.

More information? Circle Item 1 on postcard, page 122

Roof Ventilator Is Streamlined

The clean, functional contours of modern architectural design have been incorporated into a new roof ventilator introduced by Penn Ventilator Co., Philadelphia, Pa.

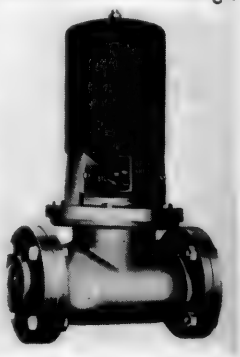


Called the Domex, the ventilator features a spun-aluminum housing which offers lifetime weatherproof protection. The ventilator's simplified construction keeps installation costs low and affords easy access to all moving parts, though virtually no maintenance is required. Available with direct or V-belt driven centrifugal fans, it is manufactured in a wide range of sizes and capacities to accommodate most ventilation problems and building designs.

More information? Circle Item 2 on postcard, page 122

Gas Valves Are Motorized

A line of motorized valves for automatic fuel control on gas-fired boilers, furnaces, ovens, kilns, and other gas combustion systems, is announced by Eclipse Fuel Engineering Co., Rockford, Ill. Two wire motor operator, soft neoprene seat construction, and lightweight aluminum body (FM approved) are features of the valves.



The spring loaded plunger and neoprene seat assure positive shut-off in the event of electrical failure. The motor and plunger assembly can be removed for servicing the valve without breaking line connections. Position of the diaphragm (open or closed) is shown by an indicator on the motor mounting bracket.

Flange mountings, with aluminum companion flanges, are furnised as standard equipment. The valves are high capacity, for all commercial fuel gases. They are now in production in 1, 1¼, 1½, 2, 3, and 4-inch sizes.

More information? Circle Item 3 on postcard, page 122

High-Output Space Heaters

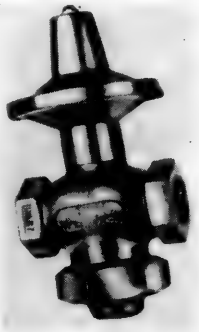
Two large highboy furnaces are being produced by Delta Heating Corp., Trenton, N. J. Designated Models HB-160 and HB-210, the outputs of these furnaces are respectively 160,000 and 210,000 Btu per hr at the bonnet.

As highboy furnaces they are shipped with the filter located at the bottom of the furnace for bottom cold air return, with further provision for returning the air at either the right or left side of the furnace. The return air attaches to a side filter bracket supplied with each furnace. For space heating, an accessory bonnet is supplied which consists of a rectangular plenum with die-formed louvres on each of its four sides. These louvres can be adjusted to direct air in any direction and at any desired horizontal pitch. The four pipe legs are supplied with the accessory diffuser bonnet. The legs raise the furnace 6 inches from the floor and the return cold air must pass through the filter located at the inside and at the bottom of the furnace before that air is heated. The heat exchanger is constructed of a heavy gauge steel and it is of tubular design similar to the larger Delta horizontal furnaces. The combustion chamber is made of pre-formed refractory material. A Delta flanged gun-type oil burner attaches to the front of the furnace by means of stud bolts provided. The furnace, as a regular highboy unit measures 30 inches square by 5 ft 2 inches in height.

More information? Circle Item 4 on postcard, page 122

Combined Safety Shutoff Valve

A combination safety valve that protects against overpressure and fuel-fed fires in gas installations is being manufactured by Valco Inc., Cincinnati, Ohio. Designated as Model No. 350, this valve is designed for installation just ahead of gas meters in homes, hospitals, schools and public buildings.

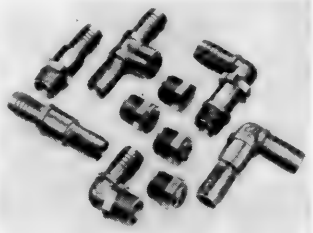


According to the manufacturer this new valve can be mounted in any position, even upside down. The valve can be located in any section of a convenient piping arrangement between the gas meter and the pressure reducing valve. Simple in design, the fundamental tripping mechanism assures instant, positive operation. Positive shutoff eliminates leakage in the gas line beyond the valve due to overpressure or fire. The manufacturer further states that this combination safety shutoff valve eliminates the possibility of premature shutoff due to vibration in the line, as its construction is completely vibration-proof. The design of this valve also makes it completely explosion-proof. The entire operating head can be knocked-off in an explosion and the valve remains closed. The flow of gas is under the seat. When closed, only the disc and spring is needed to prevent flow.

More information? Circle Item 5 on postcard, page 122

Fittings for Plastic Pipe

Twenty-seven special-purpose fittings for flexible plastic pipe have been added by Franklin Plastics, Inc., Franklin, Pa., to their line of standard adapters, couplings, tees and ells.



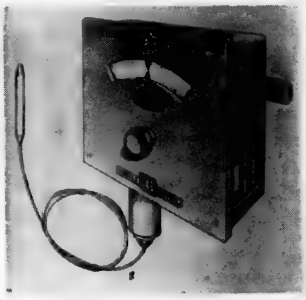
The new line is composed of extra length couplings, adapters and elbows for bacteria-free water well installations, long and short adapter elbows to simplify linkages used in jet pump hook ups, and insert reducing tees with female threads in the stem. The well-seal parts make it possible to seal water well casings germ-free at the top where the water pipes enter. The smooth seating area is of sufficient length to provide a solid land for a rubber well-seal. The long and short adapters make water system installations less expensive by saving up to five fittings. The insert reducing tees are designed for use in lawn sprinkler systems and other situations where it is necessary to branch from a plastic pipe with a smaller metal of plastic stem. A companion line of reducer bushings and plugs also is provided.

All of the new items feature smaller secondary leak sealing serrations in clamping areas in place of a smooth barrel. They have a hex where applicable for easy handling, and the material is corrosion resistant virgin polystyrene copolymer.

More information? Circle Item 6 on postcard, page 122

Remote Temperature Controller

A low-cost remote indicating temperature controller, claimed to be accurate within 1% of full scale under most conditions has been developed by Fenwal Inc., Ashland, Mass. This controller is designed for temperature control in ovens, packaging and processing equipment of all types.



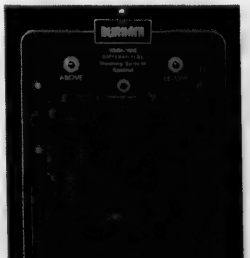
Called the Series 540, the controller has a temperature operating range of 100 to 700 deg F with uniform sensitivity throughout the range. It may be flush-mounted or surface mounted, as desired. The indicating controller operates on a liquid-filled bulb and capillary system whose response to temperature change is transmitted to a bellows assembly and thence to the indicating pointer through a simple mechanical linkage. Backlash is eliminated at all linkage points by spring-loading the final lever element so as to keep all bearings in the series tightened. The control temperature is set with an adjusting knob on the front panel of the instrument. The control set-point establishes the temperature at which the heater circuits are turned on; these circuits will be turned off at some higher temperature, depending on the desired differential (adjustable between 0.8 and 4% of full scale).

The bellows assembly is self-compensating for changes in ambient temperature in the range of 50 to 150 deg F. The entire unit may be exposed to —65 deg F indefinitely without damage. Capillary tubes are available in standard lengths of 6 and 10 ft. The temperature-sensitive bulb is 5 11/32 in long and ¼ in in diameter, but other bulb configurations can be obtained. The case is approximately 6¾ in square and 2¾ in deep.

More information? Circle Item 7 on postcard, page 122

Control Panel Is All-Electronic

Development of an all electronic temperature control panel is announced by C. A. Dunham Co., Chicago, Ill. This panel has been added to the company's Vari Vac line of automatic temperature control equipment and systems.

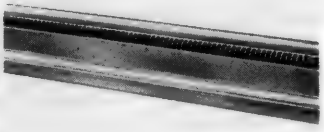


All moving parts are contained within a single, compact amplifier unit which is held in place by only two thumb screws and a plug type electrical connection. No wiring connections need be broken within the panel in the installation or removal of the amplifier unit. The plug type electrical connection suffices. It is claimed this new control panel is extremely durable and able to stand up under very rugged treatment.

More information? Circle Item 8 on postcard, page 122

Baseboard Perimeter Diffuser

An improved No. 180 baseboard perimeter diffuser, featuring better performance and easier installation, is announced by Air Control Products Inc., Coopersville, Mich.

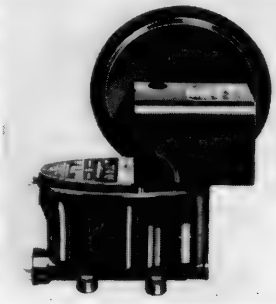


Increased free areas of 29.36 sq in. on the 4-ft size and 14.68 sq in. on the 2-ft size give a more efficient pattern with less resistance. Base design permits diffusers to be installed before or after plastering on sub-floor or finish floor. Front face is removable at any stage of installation. Knock-out strips speed installation of diffuser to fittings. On 4-ft size, strips are simply knocked out with hammer to suit fitting. 2-ft size has pre-cut hole for 12-inch fitting, knock-outs to accomodate 14-inch fitting.

More information? Circle Item 9 on postcard, page 122

Safety Devices for Fans

Recently added by A-P Controls Corp., Milwaukee, Wis., to its line of oil controls are two Air Prover safety mechanisms. The devices provide safety fan control for pressurized burners and may be used with the company's constant level oil control valves. They provide a method of preventing excess oil flow in the event of air failure, going into action when air flow is interrupted due to electrical failure, mechanical fan problems or a clogging of the fan.



The Model 113A Air Prover (shown at right) which may be used manually or thermostatically, reduces oil flow to a safe rate whenever air failure occurs. It is completely mechanical and requires no electrical connections. It can, however, be supplied with a snap switch which will provide means for shutting off the fan. Air pressure against a diaphragm actuates the device, thus moving a lever arm to allow full oil flow. Oil flow can then be controlled manually or thermostatically, as the case may be, between low and high flow setting. If equipped with a fan switch, the fan switch lever shuts off and turns on the fan in response to the oil flow setting. (Pressure required to actuate diaphragm, .20 inch water).

The other model, 114B, (shown at left), is actuated by a thermally responsive bimetal element located in the air stream, and automatically reduces oil flow to a predetermined rate. The bimetal element keeps a constant safety check on air flow and trips out within seconds whenever trouble develops. This model is available for use with continuous or intermittent operation of combustion fan. Means for mounting the 114B on a number of popular make fans has already been developed. Fan manufacturers can provide suitable housings to accommodate the device. Mounting positions can be determined for fans made by most manufacturers.

More information? Circle Item 10 on postcard, page 122

Forged Aluminum Hose Connector

The development of two types of forged aluminum hose connectors claimed to be many times more ductile than previous cast aluminum types, is announced by Tube Turns, Div. of National Cylinder Gas Co., Louisville, Ky.

The first of the two types, a loose flange type connector, consists of a long lap joint stub end and a loose back up flange. The barrel of the stub end is provided with rings to anchor the hose. The back up flange may be freely rotated without lifting the heavy hose, thus easing strain on workers. The entire assembly is fabricated of high strength forged aluminum 61St-6 alloy.

The second type, an integral type connector, consists of a welding neck flange welded to a pipe equipped with welded anchor rings. This assembly is also fabricated with high strength forged aluminum 61St-6.

More information? Circle Item 11 on postcard, page 122

Unit Prevents Scale, Corrosion

A new piece of equipment for the treatment of water and other incrustating liquids is the Cepi-Comav unit being marketed by Cepi-American, Inc., Columbus, Tex.

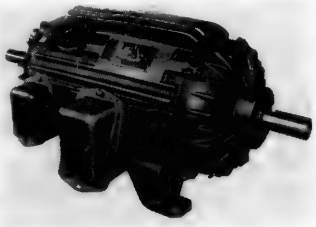
The liquid to be treated passes through a tube containing very concentrated magnetic fields. Water, after passing through these fields, loses the ability to develop scale and corrosion and will also eliminate any that has formed in the piping or other equipment. The crystallizing nature of the salts, in solution, is changed by the magnetic fields so that instead of forming scale, they drop out as a fine powder that may easily be removed by blowdown or flushing with a stream of water. The unit is permanent and automatic and is manufactured of anti-corrosive metals. Special units are made for the treatment of sea water, sugar juices and other liquids. The device can be installed in any water line as units up to 2 inches are threaded and are equipped with flange fittings from 2½ inches up. Sizes run from ½-inch with a capacity of four gallons per minute to 40 inches with a capacity of one million gallons per hour.

The product will treat a large range of hard waters and the treated water will retain this treatment for many hours. It requires no maintenance and is fully automatic and carries a money-back guarantee. It finds application with air conditioning equipment, boilers, hot water heaters, heat exchangers and kitchen equipment.

More information? Circle Item 12 on postcard, page 122

Wound-Rotor Motor Introduced

A rib-type enclosed, fan-cooled wound-rotor motor made with slip rings, brushing rigging, rotor and stator inside a single frame enclosure is announced by Allis-Chalmers Mfg. Co., Milwaukee, Wis.

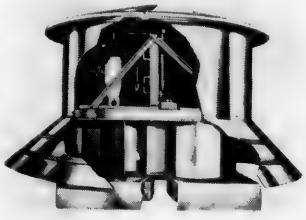


The first of this company's explosion-proof wound-rotor motors to bear the Underwriters' Laboratories label, the unit is available at 1800 rpm and slower speeds, in frames 284 to 505, in standard enclosed or explosion-proof construction. The motor is applicable where very low starting current, high starting torque, smooth acceleration, jogging or variable adjustable speed dictate the use of a wound-rotor motor and where moist, dirty, corrosive, or hazardous atmospheres require a totally enclosed motor. The frame of the motor has an extended front end to include the slip rings, brushes and brush rigging in one enclosure. The elongation provides added surface for heat dispersal. Removal of two large pipe plugs from the upper quadrants of the frame on the slip-ring end provides large openings for maintenance work and adjustment of brushes and brush rigging. Slip-ring leads enter a separate cast-iron conduit box and the lead opening in the frame is sealed.

More information? Circle Item 13 on postcard, page 122

Power Roof Exhauster

A Type B exhauster, available with either direct or V-belt, has been made available by Chicago Blower Corp., Chicago, Ill. Noise level is kept to a minimum by an air-flow design which allows the lowest possible wheel tip speeds. Air cut-off guide vanes are stationed at cut-off points simulating the scroll design of a centrifugal fan housing.



The frame is of heavy all-welded construction. Housing, motor and fan wheel can be removed without disturbing rest of unit. Housings can be furnished in aluminum, galvanized iron, copper, stainless steel or any other special metals. The wheel is the backward curve type, of all-welded construction with $\frac{1}{8}$-inch thick fins, $\frac{1}{4}$-inch back plate and heavy hub, welded together, then balanced statically and dynamically for vibrationless operation. Wheels can be furnished in stainless steel as well as other alloys. The discharge cone is designed to utilize the spin of the air which is discharged off the peripheral edge of the wheel to enter surrounding atmosphere with an absolute minimum of turbulence and discharge loss. Base supports are constructed of structural angles and heavy steel plate, floated on vibration eliminators of rubber so there is no metallic contact between driving assembly and the rest of the exhauster.

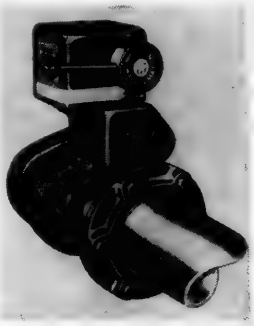
The motor is completely isolated from exhausting air and can be furnished for any current characteristics. They are furnished either standard open, totally enclosed or explosion proof. V-belt drives are supplied in either single or multiple belt types. The motor base is mounted on sliding rails for simple V-belt adjustment. Safety disconnect switches are furnished with each exhauster. Automatic louvers, either air or motor operated, and which are easily mounted inside the curb, can be furnished. All louver blades are felt lined, eliminating any noise when closing. These exhausters are shipped fully assembled, complete with motor, drive assembly, frame, housing and safety switch for easy installation.

The direct motor drive power exhausters deliver from 830 to 2590 cfm sizes ranging from 107 to 150 with static pressures from $\frac{1}{8}$ to $\frac{3}{4}$-inch. V-belt drives deliver from 1420 to 29,750 cfm in fan sizes from 122 to 440 with static pressures of $\frac{1}{8}$ to $\frac{3}{4}$ inch.

More information? Circle Item 14 on postcard, page 122

6-Inch Safety Valve

Designed to shut off flow of fuel automatically and instantly in case of power failure or other trouble, a six-inch flanged type safety valve is placed on the market by Maxon Premix Burner Co., Muncie, Ind. The valve is applicable to fuel lines leading to industrial furnaces, ovens, boilers and other heating equipment.

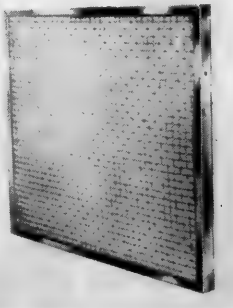


Of manual reset design, the valve must be reopened manually after any interruption in service. It cannot be reopened until the interlocking safety circuit is complete and the electric holding coil is re-energized. Approved by Factory Mutual Laboratories, and Underwriters Inc., the valve is used as a safety protection against fire and explosion.

More information? Circle Item 15 on postcard, page 122

Filter Has Synthetic Fiber

A synthetic fiber blanket which catches and retains dust by accumulated static charge is introduced as the media in a one-inch Dycon dry air filter manufactured by Continental Air-Filters, Inc., Louisville, Ky.



Designed primarily for use in domestic and commercial installations of air-conditioners, warm-air furnaces, and air handling equipment, the filter is a large capacity high velocity type, which can be easily rinsed under a cold-water faucet or nozzle-less hose and returned to service immediately. Its frame is aluminum to eliminate the problem of rust.

More information? Circle Item 16 on postcard, page 122

Year-Round Unit Saves Space

The marketing of a new year-round residential air conditioning combination, the Spacesaver, has been revealed by Airtemp Div., Chrysler Corp., Dayton, Ohio.

Every home being built and every older home with forced air heating can be air conditioned, claims the manufacturer, stating that the problem of lack of space for the installation of residential air conditioning equipment has been solved with the development of a V type cooling coil. Incorporated as part of the furnace, the V coil provides air conditioning with no loss of valuable floor space, requiring only 14½ inches of additional height above the furnace. A complete unit includes the V-coil (available in four models), waterless or water cooled condensing unit, and Lo or Hi-Boy furnace. Seamless copper tubing is used to pipe Freon refrigerant between the coil and condenser. The latter chan be located outside the home, in the garage, in the sub-floor crawl space or basement. The furnace blower forces home air through the coil, cooling and distributing the air throughout the home.

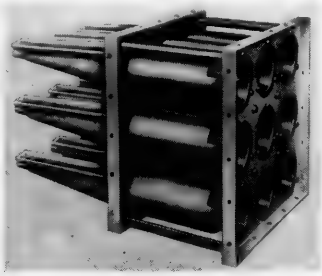
The V-coil, while specifically developed for the Spacesaver combination is also available separately. It is adaptable to other forced air furnaces which have adequate blower capacity.

More information? Circle Item 17 on postcard, page 122

Dust Collector Has New Twist

An outside-in twist that reverses the normal tangential flow of most centrifugal dust collectors is credited by American Air Filter Co., Inc., Louisville, Ky., with giving its Amerclone dry granular dust collector high efficiency over a wide range of air volumes.

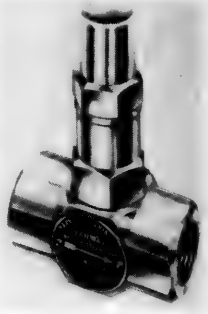
Heart of the development is a conical inlet which imparts a swirling motion to dust particles, while permitting clean air to travel through the Type G Amerclone tube without changing direction. Each tube has an approach velocity of 1,000 fpm and a cleaning capacity of 333 fpm. Nine tubes are combined in a standard modular cell, which has a nominal rating of 3,000 cfm with a face area only 20 inches by 20 inches. Any number of the modular cells may be combined to achieve required capacity within available space. The manufacturer claims that because of this simplified straight through air flow design, the units can handle widely fluctuating air volumes and dust concentrations with almost constant efficiency. This makes them particularly effective in eliminating fly ash when boilers blow off. The basic unit includes a secondary exhauster circuit which provides for disposal of the 10 per cent of the primary air, and collected dust, bled off by the tubes. The company claims material space savings with the unit, because each tube has two to three times the rated capacity of conventional collectors of comparable size. Built of thick wall gray iron castings, with no recirculation of dust load, the tubes are unusually resistant to abrasion. The standard Amerclone is limited to temperatures of 750 deg F. Special materials may be employed for higher temperature applications. The unit has a pressure drop of 4½ inches at standard air (70 deg F, 29.92 inches hg).



More information? Circle Item 18 on postcard, page 122

Steam Trap for Light Loads

A new ½-inch Yarway impulse steam trap, the 20-A, designed with low capacity to handle light condensate loads, is placed on the market by Yarnall-Waring Co., Philadelphia, Pa.



The manufacturer states that the 20-A impulse steam trap will not freeze or air bind on steam tracer line service, and gives good performance on other light load applications like small platens, autoclaves, hospital sterilizers, unit heaters, or clothing presses. Other features are small size, low cost, body and all working parts made of stainless steel, good for all pressures to 400 psi.

More information? Circle Item 19 on postcard, page 122

Fittings for Hose Assemblies

Reusable high pressure, hydraulic couplings requiring no special tools for hose assemblies and a ninety degree swivel elbow are offered by Sales Export Div., Condamatic Co., New York, N. Y.

Called Hydralink, the reusable couplings are available in a standard range of sizes for both one and two wire braided, rubber covered hoses and are engineered for on-the-job installation. Both fixed and swivel male end couplings are available. The manufacturer states that the couplings will withstand pressures greater than the rated burst pressures of the wire braid hose and other types of couplings. A complete line of adapters and fittings for all standard installations is also available.

The ninety-degree swivel elbows are designed for high-pressure hydraulic equipment and are leakproof. A full range of sizes for all standard applications is available. The elbows are designed so that they can be adjusted to any angle in their relationship to the other connections.

More information? Circle Item 20 on postcard, page 122

Heat Panel Has Hood Deflector

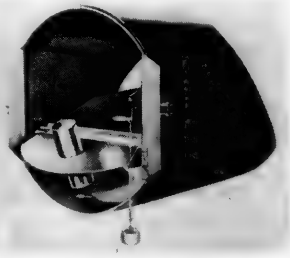
A space saving, electrically operated, Glassheat Footlighter radiant baseboard panel, incorporating a hooded deflector in the frame to eliminate wall streakage, is announced by Continental Radiant Glass Heating Corp., New York, N. Y.

The panels are constructed of tempered glass fused with aluminum strips. The heating panel's infra-red rays are projected by means of a metal reflector behind the glass. The manufacturer claims that this type of heat is completely safe and that even at a maximum temperature of 300 deg F, no blistering or searing will result from direct contact with the panel. The units may be mounted end to end in continuous fashion across a room and are particularly adapted to use under picture windows. The units are zone controlled by thermostat. The frame size is 9 inches high by 47½ inches long, with the glass size, 6 inches by 45 inches. The panel, which has 750 watt capacity, 245 volts, a.c. and d.c. current, comes in neutral hammertone grey finish, and may be painted to suit any decor. The units carry the Good Housekeeping seal and U. L. approval.

More information? Circle Item 21 on postcard, page 122

Draft Control in 8-Inch Size

Its Field MG draft control for gas-fired commercial heating plants is now being manufactured in an 8-inch size, by Field Control Div., H. D. Conkey & Co., Mendota, Ill.



The 8-inch model is 20 gage steel, with a 12 gage ring and 18 gage side plates. The largest, a 24-inch model, has a ¼ x 2-inch steel ring and 14 gage gate and 16 gage side plates. The MG series is a double acting control with the gate opening inward to regulate updrafts and opening outward to relieve down drafts. It is available with an optional safety switch which closes the main gas valve in the event of a prolonged down draft.

More information? Circle Item 22 on poscard, page 122

Two-Wire Thermocouple

A two-wire thermocouple, encased in stainless steel tubing, is introduced by Industrial Div., Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.

The device is available with either of two types of terminal heads; and open head assembly or a screw-cover head. The screw-cover head is available in two sizes. The manufacturer states that a stainless steel protecting tube is expected to double the life of the new thermocouples. Accuracy of the new device is rated at plus or minus 5 deg F over a range from 0 to 1000 deg F. Lengths of the thermocouples range from 6 inches to 60 inches. Lengths of 35 feet are available on a special basis.

More information? Circle Item 23 on postcard, page 122

Vent Valve Has Male Connection

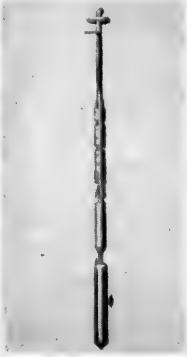
The No. 33 Vent-Rite venting valve, a new convector vent with a male connection, is announced by Anderson Products, Inc., Cambridge, Mass.

This latest addition to the company's line of venting valves has been added to supplement the No. 37 Valve, which has a female connection. The No. 33 vent has a ¼-inch pipe thread male connection. It is finished in bright nickel and is constructed of non-rusting and non-corroding materials. It has a thermofloat to insure positive closing and opening and to act as a seal against water. Overall height of the valve is 3⅛ inches. Each valve is tested at the factory and then wrapped in tissue and individually boxed.

More information? Circle Item 24 on postcard, page 122

Pump Has New Component

The Pressurmatic, a non-mechanical oil pressurizing system for submersible pumps, is featured in the Subette pump, a product of Byron Jackson Co., Los Angeles, Calif. This feature provides automatic sealing pressure to the oil in the motor without the use of mechanical devices. An additional feature is that the Pressurmatic tank keeps the pump and motor off the sediment-filled bottom of the well.



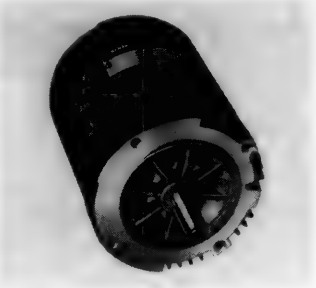
The submersible pump is packaged for water requirements ranging from 30 to 260 gpm from wells 6 and 8-inch I.D. and larger. Available motor sizes range from 5 to 35 horsepower. This pump is adaptable to crooked wells because the close-coupled submersible motor and pump eliminate shaft problems. The motor is unaffected by weather extremes and will run for years without attention. The pump, which is close-coupled to the submersible motor, is selected to fit the specific requirements at hand. One of the important pump operating benefits stressed is the use of extra spacer bearings to increase pump life.

Recommended applications include primary water supply and booster applications for motels, hotels, industrial plants, dairies, golf courses, small cities and communities, refineries, canneries, schools, estates, parks and water pressure systems. Agricultural uses include irrigation, stock watering and pressure systems, while industrial uses include pumping water for processing and washing, fire fighting, and cooling towers.

More information? Circle Item 25 on postcard, page 122

End-Mounting FHP Motors

An end-mounted fractional horsepower motor, equipped with a new grease for increased bearing life, is announced by General Purpose Component Motor Dept., General Electric Co., Schenectady, N. Y. The grease, a result of research and operating tests, is claimed to give long lubrication with little maintenance, and aid the ball bearings to absorb heavy end-thrust loads easily.



The manufacturer states that a new synthetic slot and between-phase insulation of Mylar polyester film, Formex wire and Glyptal varnish make stator windings highly resistant to heat, aging, moisture, and electrical stresses. Ventilation with a large, cast-aluminum fan produces a quiet, effective cooling system. The motor is available in open, and totally-enclosed, fan-cooled models, NEMA size 56C face mounting. The capacitor-start and polyphase open models are designed for operation of close-coupled centrifugal pumps. Mounted either vertically or horizontally, they are suited for continuous or intermittent operation. The totally-enclosed, fan-cooled model is designed for applications located in dirty or unfavorable conditions, such as certain machine tools, compressors, pumps, and materials handling systems. Both models are available in ratings of ¼, 1,725 rpm, to 1 hp, 3,450 rpm.

More information? Circle Item 26 on postcard, page 122

Heating Element Has Many Uses

A copper-clad electrical heating element said to offer precision heat control and wide application has been developed by Continental Electric Equipment Co., Cincinnati, Ohio. The manufacturer claims that the heating unit can be wrapped around almost anything, immersed in any solution non-corrosive to copper, or enclosed in any material.

Called Heatflex, the heating element consists of a seamless sheath of self-annealing copper in which is enclosed a pair of copper resistance wires, spaced and insulated by a tightly packed magnesium oxide. Features listed by the manufacturer are heat-resistance, non-inflammable, self-grounding, flexible, waterproof, chemical resistant, and resistance to thermal shock. The unit is approximately ¼-inch in diameter. Hot and cold sections can be produced in any length to suit job requirements. Fittings on the element are slightly larger in diameter and are available for tanks and pressure vessels as well as for connection to electrical junction boxes or other enclosures.

Applications of the device are keeping viscous materials like heavy oils, asphalt, molasses, or paraffin flowing; removing or preventing ice formation on outdoor equipment, steps, walks, driveways, platforms, catwalks, or ladders. It can be used to heat tank car contents for quick dumping, to prevent freezing of water seals on gas holders and for controlling ice formation in refrigerated rooms.

More information? Circle Item 27 on postcard, page 122

Add-On Air Conditioners

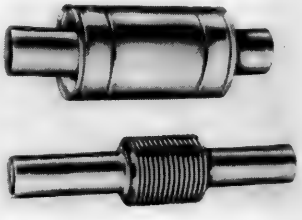
A line of year-round air conditioners of the type that can be joined to almost any existing forced air heating system, is announced by Frigidaire Div., General Motors Corp., Dayton, Ohio.

The add-on air conditioner line offers units in 2, 3 and 5-ton capacity sizes and stresses great flexibility of installation in conjunction with any forced air furnace, whether in an older home or new construction. The units are designed and fabricated to be installed as a complete unit or in sections. Decorative steel side panels can be removed and the coil and fan section lifted from the top of the compressor section and installed separately. Either of the sizes can be placed in the basement next to the furnace, in a utility room, or even the attic. For example, the fan and coil might be connected to ductwork in an attic and the compressor installed in the basement or even outside the house or building.

More information? Circle Item 28 on postcard, page 122

Bellows Type Expansion Joint

An expansion joint designed to compensate for thermal expansion, reduce vibration and noise transmission and to allow for misalignment in piping systems is announced by Clifford Mfg. Co., Waltham, Mass.

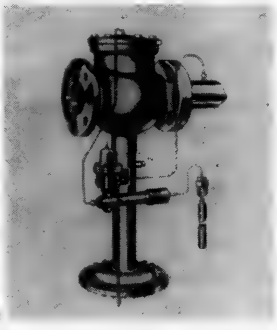


The joint is constructed around a seamless bronze bellows hydraulically formed and very rugged. Flexing of the bellows compensates for thermal changes without the need for stuffing boxes or packing glands and permits unitized construction. The casing is of corrosion resistant seamless brass tubing. An ample length of tubing is provided at each end for normal sweat fitting connection to the system. The unit can accommodate pipe movements up to one-half inch in expansion. A protective secondary seal is provided at both ends of the joint as a safety factor against the possibility of leakage due to damage to the joint or heating system. This consists of a fiber element which expands when wet to form a tight seal until corrective action can be taken. The expansion joint is available in three sizes for ¾, 1 and 1¼-inch piping systems.

More information? Circle Item 29 on postcard, page 122

Temperature-Pressure Control

A single main valve which gives both temperature and pressure control is announced by Klipfel Valves, Inc., Hamilton, Ohio. The valve is known as No. 1649. It is designed to prevent the hunting, cycling or overheating that sometimes occurs with a temperature control alone.



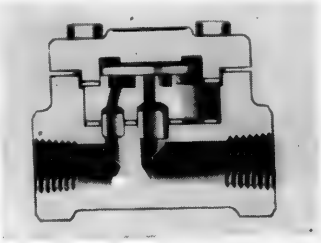
In operation, the valve is set to meet the maximum demand of the system pressure-wise. The pressure reducing function operates with downstream pressure sensed by the pilot valve which opens or closes to maintain set pressure. This action is supplemented by the temperature control pilot which shuts the main valve when the temperature control point is reached. This closing occurs regardless of downstream pressure. When the control temperature falls below the set point, the main valve opens and the pressure reducing function resumes automatically. The pressure range is 5 to 125 lb. The temperature adjustment range is 50 deg F. Standard temperature ranges are: 25 to 75, 75 to 125, 125 to 175, 150 to 200, 175 to 225 and 225 to 275 (all in deg F.)

Sizes 2 inches and over have semi-steel bodies, smaller sizes have bronze bodies. Stainless steel valve trim is used in sizes 4 inches and smaller, larger sizes have bronze trim standard but can be supplied with stainless. Eight feet of capillary tubing and a nickel plated bulb is standard on all sizes.

More information? Circle Item 30 on postcard, page 122

Thermodyamic Steam Trap

A thermodynamic steam trap, in which the kinetic energy of steam closes the valve, is introduced by Sarco Co., Inc., New York, N. Y. The trap is claimed by its manufacturer to have trouble-free operation due to a new operating principle which permits elimination of the usual valve mechanisms, devices, fragile parts, and narrow channels.



The trap's only moving part is its solid heat-treated stainless steel disc valve head. The manufacturer states that the same head and seat are used for pressures to 600 psi and temperatures to 950 deg F. Operating characteristics of the thermodynamic trap are: closes tight on no load, and operates against a back pressure up to 50% of its inlet pressure; discharges condensate at saturated steam temperatures as rapidly as it forms; and can vent large volumes of both air and air-steam mixtures. The starting load capacity of the trap is stated to be very high, but it operates equally well with light loads or no load. The trap, which is not affected by pressure variations, is designed to work just as efficiently at 1 psi as at 600 psi.

The manufacturer claims that the design and metals used enable the steam trap to withstand superheat, water-hammer, vibration, and corrosive condensate. A compact unit, the 1-inch size has dimensions of 3½ x 4¾ x 4 inches high. The trap body is of cast semi-steel, carbon or moly steel with screwed socket weld or flanged connections.

More information? Circle Item 31 on postcard, page 122

Stainless Steel Solenoid Valve

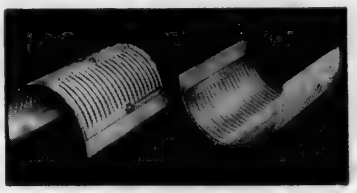
A stainless steel solenoid operated 2-way valve with high resistance to corrosion has been placed on the market by Automatic Switch Co., Orange, N. J.

These Bulletin 8265 stainless steel valves are designed to control gases and liquids generally corrosive to bronze, steel, or iron at pressures to 250 psi. They are normally closed (close when de-energized, open when energized) valves. Heavy duty construction throughout, particularly of the three moving parts, makes the valves suitable for operation at a frequency of 400 times per minute and, the manufacturer claims that under these conditions, they will give millions of trouble-free operations. In addition, solenoids are of the floating core construction which provides freedom from core chatter. All internal parts are readily accessible without removing valve body from pipe line. Sterilizing or cleaning can be done by merely removing valve bonnet. Continuous duty Class A coils for temperatures to 212 deg F are provided. High temperature Class H coils are supplied for temperatures to 450 deg F. Available in ⅜ inch IPS solenoid enclosures to meet NEMA Standard, watertight requirements.

More information? Circle Item 32 on postcard, page 122

Heat Panels in Special Shapes

The announcement that its Thermo-Panels are available not only in flat plates but in special shapes (as illustrated) is made by Thermo-Panel Div., Dean Products, Inc., Brooklyn, N. Y.

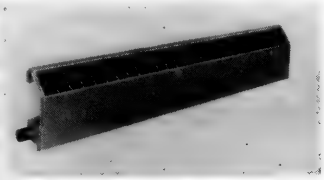


With this type of heat panel it is possible to place these around tanks, under troughs, or similar installations. The panels are also incorporated in the construction of tanks, vats, and kettles, where they are used as part of the structural elements of the vessels. The manufacturer claims that they are easier to install and cleaner than pipe coils. The panels are also available in special shapes such as L's and cylinders and in a wide range of materials, including steel, stainless steel, Monel and other special alloys.

More information? Circle Item 33 on postcard, page 122

Space-Saving Wall Radiation

Finned pipe radiation called Temtrim, is announced by American Radiator & Standard Sanitary Corp., Pittsburgh, Pa., for application in new or modernization jobs in factories, warehouses, schools, hospitals, office buildings, ships, churches and theatres.



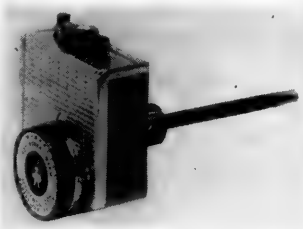
The radiator is installed along the cold outside walls of a building. The manufacturer states that because heat originates along this outside perimeter, the wall itself acts as a radiating surface, and an even, uniform blanket of warmth is emitted with spotty, drafty areas eliminated. The radiator can be installed as separate convector units or placed in continuous lengths along the wall without taking up valuable floor space in industrial and institutional installations. In school gymnasiums, high-ceiling plants and similar applications requiring greater amounts of heat, it can be hung singly or in tiers a few feet below the ceiling.

The panels are composed of steel fins bonded to pipe. Fins are connected to the pipe with a hard steel bond that cannot be broken by expansion and contraction during normal operation of the heating system. Depending upon the type of installation, it can be installed with the bare element exposed, or with one of three covers for the heating element. An expanded metal grille protects against burns without appreciable loss in heat output. A flat top cover features a louvered top section for a neat appearance.

More information? Circle Item 34 on postcard, page 122

Control for Water Heaters

A glamorized water heater control, designed for mounting outside the water heater shell yet thin enough for easy concealment, has been developed by Grayson Controls Div., Robertshaw-Fulton Controls Co., Lynwood, Calif. The control is shaped much like a cigarette case for ease of installation and, when necessary, concealment. It is 1 7/16 inches thick, 4 17/32 inches high and 4⅛ inches wide.



Designated Unitrol 200, it was designed to harmonize in both appearance and color with the clean, functional lines of a water heater shell. The body is a die-formed pressure casting, giving it a smooth, fine-finish appearance. It has a snap-on aluminum cover, available in a wide choice of colors.

The temperature dial is of colored plastic, with a metallic center disc for the water heater manufacturer's trademark. The snap-on type temperature dial can be exposed while the control itself is located inside the water heater shell. When required, the control can be completely concealed inside the shell without special forming to the water heater jacket or door. It can be hidden in two inches of insulation. A feature of the control is that it can be ordered in almost any color or color combination to match the water heater manufacturer's shell colors, or to conform with his trade mark design and harmonize with its color scheme.

The control combines a snap-action thermostat, a thermo-magnetic automatic pilot and a large capacity gas cock. It is of the 100% shut-off type, with the safe lighting feature. Its air gap construction feature prevents water from a damaged immersion element from entering gas lines. All parts exposed to gas are made of aluminum to eliminate corrosive attack by sour gases, while red brass and copper are used for all parts submerged in water.

More information? Circle Item 35 on postcard, page 122

4-Way Selector Valve

Production of a two-position, 4-way selector valve for use in low pressure air or hydraulic systems is announced by Sprague Engineering Corp., Gardena, Calif.

The valve, Model No. S-576, is leak-proof at working pressures to 100 psi and maintains low handle torque. Standard, commercially available O ring seals are used throughout to assure leak-free operation, low friction drag and simplified maintenance. Handle stops assure positive alignment of ports. A black anodized, cast aluminum body reduces weight to a minimum. Valve body dimensions are 2½ inches wide x 1⅝ inches high; overall dimensions with handle are 3¾ inches wide x 2⅝ inches high. Weight is 6 oz. The valve is available only in ¼-inch tube size per AND 10056, and it conforms to requirements of MIL-P-8564. Designed for simplified maintenance, complete disassembly of the valve may be accomplished without disconnecting system lines.

More information? Circle Item 36 on postcard, page 122

Steel Conduit Developed

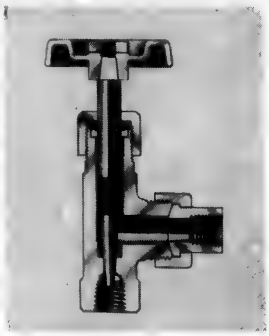
A heavy-duty rigid steel electrical conduit, Superduct, designed to provide long life under severe corrosive atmospheres such as are found in most industries has been developed by National Electric Products Corp., Pittsburgh, Pa.

The conduit is claimed to withstand the attacks of sulphuric acid, caustic lye, salt spray, and heat. The duct is galvanized by the Sherardizing process. It is then coated with a special vinyl chloride copolymer, pigmented and plasticized enamel finish, inside and out. This new finish protects the galvanized conduit against the unusually corrosive influences common in industrial plants.

More information? Circle Item 37 on postcard, page 122

Forged Needle Valve Line

A line of forged needle valves with Universal outlets featuring micrometer thread stainless steel stems is announced by Carpenter Valve Corp., Cleveland, Ohio.



Known as Bull-Dog needle valves, the bodies are forged from brass, stainless steel, or carbon steel. It is claimed by the makers that the wide range of optional machinings on outlets facilitate lower priced neat installations. No extra charge is made for any optional machining. The valves are also furnished in mountings for instrument panels.

More information? Circle Item 38 on postcard, page 122

Rubber Covered Hose Valves

A line of industrial rubber covered hose valves is placed on the market by P-K Industries Inc., North Arlington, N. J.

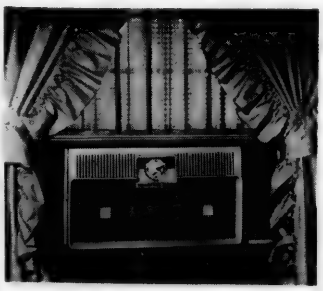
These valves are designed for wash down and tank filling applications in the food and chemical industries. Valves will provide bubble tight shut-off and are completely rubber covered to prevent accidental damage to delicate tank and vessel linings in dairies and breweries, as well as beverage, pharmaceutical and chemical plants. They are well adapted for use in any batch processing operation where periodical cleansing of tanks is required. Body and working parts are stainless steel for corrosion resistance. The valve is practically maintenance free, since there are only two moving parts with no springs or lever mechanisms. Only 5 inches long, the valve weighs 1 lb and will fit any standard ½, ¾ or 1-inch standard ID hose.

More information? Circle Item 39 on postcard, page 122

1955 Window Unit Line Revealed

Two series of window air conditioning units for 1955 are announced by Mitchell Mfg. Co., Chicago, Ill., with the introduction of the Super High Capacity Chassis series and the Bel-Aire series, with units ranging from ⅓ to 1½ hp.

The Bel-Aire series (shown at right) features louvered panels which are adjustable to 20 different directions, and the Expando-mount, a device which permits the unit to be mounted in less than five minutes. Consisting of four unit sizes, the Bel-Aire comes in ⅓, ½, ¾, and 1 hp models. Direction-Aire control permits variation in the direction of air flow by adjustment of the pre-set controlling louvers. Other features of the units in this series are flush mounting which eliminates protrusion of the unit into the room area, and the Weath'r Dial which can be adjusted to cool, ventilate, and exhaust.



The Super High-Capacity Chassis series, the second series in the company's 1955 line, consists of three models featuring a refrigeration circuit in which air is cooled and filtered twice and are claimed by the manufacturer to be capable of dropping the temperature in an average room 12 degrees in 3 minutes and 15 seconds. This series (shown at left) constitute the top end of the company's 1955 line. Available in ¾, 1, and 1½ hp models, the units in this series feature the company's Air Flow Modulation (AFM), a regulating switch that enables the unit to deliver either a concentrated column of air for fast cooling, or a gentle flow of cool air to maintain desired temperature. Other standard equipment features in this series include Weath'r Dial, flush mounting, two-speed motors, automatic thermostat, Direction-Aire control, and Expando-mount.

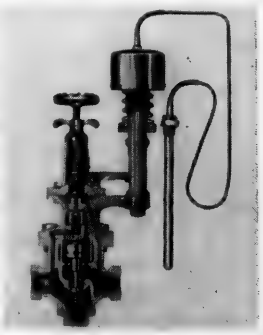
All units in the 1955 line are engineered to comply with the new ARI-EEI-NEMA joint recommendation which provides that, starting in 1956, room air conditioners have power factors not less than 85% for ¾ hp units and up. In addition, the units comply with the new National Electric Code which provides that total load of air conditioning equipment shall not exceed 50% of the rating of a branch circuit if lighting units or other appliances are also supplied and 80% of the rating of a branch circuit which does not supply lighting units or other appliances.

More information? Circle Item 40 on postcard page 122

Pressure-Temperature Regulator

A modulating pressure-temperature regulator, Type PTM, is added to the steam and liquid control equipment line of O. C. Keckley Co., Chicago, Ill.

The body of the regulator is of bronze or semi-steel, with the pilot valve, main valve, and seat of stainless steel. Available in six temperature ranges, the regulator's wearing parts are all renewable. A minimum of 10 lb pressure differential is required to operate the valve. The regulator comes in sizes from ½-inch to 2 inches with screwed ends, and from 2½ inches to 6 inches with flanged ends. As temperature tends to vary, the thermostatic control unit acts upon the pressure regulator to reduce or increase steam pressure. The manufacturer claims that pressure will modulate smoothly and rapidly between the initial setting and zero, thereby preventing overrun. The rate of pressure modulation is adjustable, giving the user a wide choice of control. The temperature control is much finer.

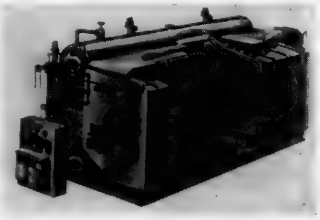


More information? Circle Item 41 on postcard, page 122

Packaged Water Tube Generators

A water tube steam generator which combines the company's Type D tube arrangement and other features for production of low cost steam in a packaged unit is introduced by Superior Combustion Industries, Inc., New York, N. Y.

These packaged units are completely assembled and fire tested at the factory before shipping. Designed for economical firing with gas, a variety of fuel oils, or both, the units are performance rated at capacities up to 40,000 lb per hr continuous steaming, and may be combined in batteries for any required total capacity. A feature of the units is the rear mounted forced draft fan which provides air cooling for the furnace roof. The manufacturer states that by mounting the fan at the rear of the boiler, the firing front is left clear for access by operating personnel, and removes noise from the area of the operator. The plenum chamber between the fan and the wind box provides for installation of steam-air preheater if desired. Other features of the units include tangent tube waterwall construction, single or multi burners, optional soot blowers, adequate manhole and inspection openings, and a shielded observation port.



More information? Circle Item 42 on postcard, page 122

Air Cleaner Line Is Expanded

The addition of two models for large commercial and industrial installations to its line of electronic air cleaners is announced by Electro-air Cleaner Co., Pittsburgh, Pa.

The larger of the two units, the Built-Up Line, is made-to order; ionizing-collecting cells are built-up to fit the exact specifications. Thus large manufacturing plants, institutions, hotels and office buildings can install correctly sized electronic air cleaners in conjunction with their heating and cooling plants. This unit is completely assembled and tested at the factory. It features all aluminum framework and aircraft construction. The units are available in all capacities at 90% efficiency.

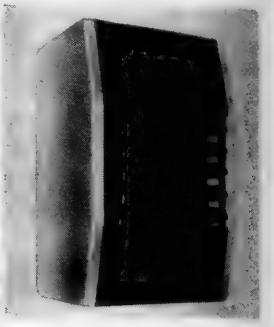
The Custom-Line unit is a packaged air cleaner, complete in a steel cabinet and designed for use where space is limited and where less capacity is needed. This model is available in sizes up to and including 12,600 cfm capacity at 90% efficiency. It may be floor mounted or suspended. Either unit is applicable in new construction or in renovation.

Both models operate by ionizing the particles of dust, soot and pollen in the contaminated entering air-stream. These particles are deposited on aluminum plates and are held until flushed away by water from built-in washing manifolds. The air next passes through expanded aluminum filters which create a slight back pressure assuring even distribution of the air across the plates and also prevent water from entering the duct-work. Pure, clean air is then ready for circulation through the heating or cooling system. Both units feature a ballasted, single circuit power supply and selenium rectifiers. These selenium rectifiers eliminate the high cost of replacing high vacuum rectifier tubes and overcome other once common sources of interrupted operation. The entire unit, including most electrical components, is manufactured solely by the company. All parts, including the selenium rectifiers, are fully guaranteed for one year.

More information? Circle Item 43 on postcard, page 122

Unit Heater Line Restyled

Announcement of a restyled line of Moncrief gas fired unit heaters is made by Henry Furnace Co., Medina, Ohio. The line of heaters features a casing with tapered adjustable louvers.

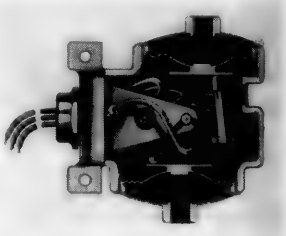


The cabinets are made of heavy gage steel with a neutral, two-tone grey, baked enamel finish. They are designed to compliment room styles and to provide a modern look for stores, restaurants, showrooms and offices. The unit heaters are available in four sizes of 60,000, 80,000, 115,000 and 170,000 Btu per hr input. Features of the units are compact, welded, one piece heating elements; mult-port, ribbon type gas burners which operate quietly and are easily removable; high pitched, propellor type fan units with rubber mountings; welded-on pipe hangers for ease of installation; and complete factory assembly so that the units need be attached to gas and electrical connections.

More information? Circle Item 44 on postcard, page 122

Pressure Difference Switch

A pressure difference switch which senses any pressure difference from 0 and 99 psi between two pressures within the working range of .05 to 100 psi is available from Barksdale Valves, Los Angeles, Calif.



Called the Meletron Model 462, the unit will actuate an electric circuit on increase or decrease of any predetermined pressure difference within the range of the switch selected. The unit is readily adjusted in the field by means of an adjustment ratchet, and has a tamper-proof cover which protects against accidental disturbance. The switch operates in any position which simplifies installation and eliminates balancing and levelling. The manufacturer states that the functions of the switching or pressure sensing elements are not affected by jarring or mobile installations or by vibrations from pumps and compressors. The unit has a splashproof housing which protects the entire mechanism from dust or damage in exposed locations.

More information? Circle Item 45 on postcard, page 122

(*Continued on page* 114)

YORK CORPORATION USES *REVERE* COPPER WATER TUBE

ONE OF THE 964 cross connections of Revere Copper Water Tube located in the 18 risers covering 14 floors. 13,000 feet of Revere non-rusting Copper Tube were used, in sizes from ¾ to 4. Picture, if you will, [illegible] connections in these cramped quarters with pipe that couldn't be bent and had to be threaded!

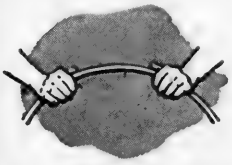
...IN AIR CONDITIONING 14 FLOORS OF NETHERLAND PLAZA HOTEL CINCINNATI, OHIO

Engineers of the York Corporation told us that they used Revere Copper Water Tube on this job for a number of reasons. Installation of the risers was simplified because no threaded connections were necessary, there were fewer fittings and what few fittings were necessary, were readily soldered. They knew from years of past experience with non-rusting copper that they could count on this "ageless" metal to endure through the years. Also, York Engineers consider copper a natural for air conditioning installations.

In fact, you could almost say, "Where there's air conditioning there's copper." Check the many advantages of copper water tube at right and you'll readily see why.

Keep out of trouble, protect your reputation for quality work, with copper. Use Revere Copper for air conditioning lines, radiant panel heating, hot and cold water lines, underground service lines, waste stack and vent lines, processing lines. See the Revere Distributor nearest you today. And, if you have a technical problem, he will put you in touch with Revere's Technical Advisory Service.

WHY REVERE COPPER WATER TUBE IS PREFERRED FOR AIR CONDITIONING

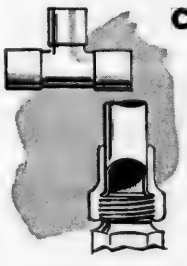


EASY TO BEND
Saves Time

Revere Copper Water Tube is easy to bend. Soft temper can be bent by hand to meet installation conditions.

HANDY LENGTHS
Save Fittings... Labor

Revere Copper Water Tube comes in straight lengths of 20' in hard and soft tempers. 60' coils of soft temper reduce the number of fittings needed.

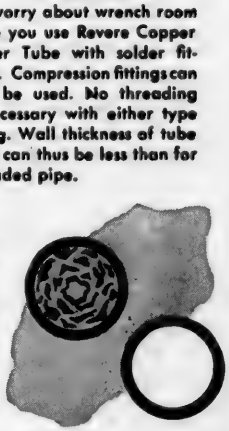


SOLDER OR COMPRESSION FITTINGS
Need Less Work Room ... Save Metal

No worry about wrench room when you use Revere Copper Water Tube with solder fittings. Compression fittings can also be used. No threading is necessary with either type fitting. Wall thickness of tube used can thus be less than for threaded pipe.

NON-RUSTING

Rustable pipe eventually clogs as shown in drawing at top right. Non-rustable Revere Copper Water Tube suffers no loss of flow or pressure as shown at bottom right. No allowance in pipe size need be made for rust accumulation with Revere Copper Water Tube.



REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801
230 Park Avenue, New York 17, N. Y.

• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere

SEE "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

(*Continued from page* 112)

Level-Differential Monitor

Utilizing bubble-tube principles of differential static pressure, a control manometer, and a relay-actuating electronic switch, the Model DL Belmont Differential-Level Monitor introduced by Thermo Instruments Co., Belmont, Calif., finds applicability in chemical, sewage, water-works, utility, power-generation, and similar operations where it is necessary to measure or maintain a limited level differential between two points.

Built into the compact, industrial-style instrument housing is a metering-type air compressor which supplies air to separate bubble tubes located at the two points in question. These bubble tubes are connected to the opposite arms of the control manometer, which then gives a continuous indication of static pressure differential and thus liquid-level differential. At the present limit, the control manometer actuates the electronic circuitry so that a built-in relay operates. External auxiliary equipment can be connected to this relay on either a normally-open or a normally-closed basis. Equipment up to 1 hp capacity can be controlled directly, larger units being handled by an intermediate power contactor, which is optional as internal equipment.

All parts of the instrument are included in a gasketed sheet-steel case 11 by 17 by 11 inches, provided with ¼-inch internal pipe connections for the two bubble tubes, and terminals for primary-power as well as control-circuit connections. The case is designed for either wall or flush-panel mounting. Electronic circuitry is in a removable drawer-type plug-in chassis for servicing convenience. Total weight of the unit is 60 pounds.

More information? Circle Item 46 on postcard, page 122

Additions to Drier Line

Two series of catch-alls have been added to the line of driers manufactured by Sporlan Valve Co., St. Louis, Mo.

The Model C-R424 is introduced to provide a replaceable core type drier in the small capacity range. This model is used on air conditioning systems up to 5 hp and has a nominal capacity rating of 3 hp on systems operating below 32 deg F. The core of the C-R424 contains 42 cu inches of effective desiccant volume, 67 sq inches of filtering and is easily replaced in the catch-all shell. This model is available with ⅜ inch ODF-½ inch ODM connections. The 300 series will be used on air conditioning systems up to 7½ hp while carrying a nominal rating of 2 tons on systems operating below 32 deg F. These catch-alls are the sealed type, have 30 cu in effective desiccant volume and a 53 sq inches filtering area. They are available with conventional inlet and outlet sizes for both flare and solder connections.

More information? Circle Item 47 on postcard, page 122

Pipe Line Cut-Off Flanges

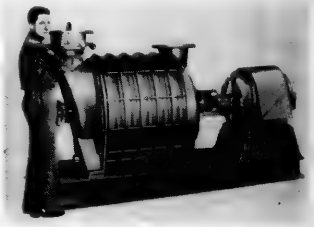
The availability of the pipeline figure eight cut-off flange in any size, carbon steel or alloy, to satisfy the particular specifications of the user is a new service of H. F. Butler, Inc., Union, N. J. Heretofore, figure eight flanges or a product of similar construction and purpose has usually been produced by the maintenance shops of the company using the flange.

Primarily designed to serve the needs of the petroleum, chemical processing and allied industries, the figure eight flange fits between the flanged joints of a pipe line. Thus a line which is closed off infrequently can be closed or opened without the need of gate valves. As illustrated, the flange is made in two sections, a disc and a ring, and joined by welding. The flanges are machined for good gasket seating or may also be supplied for ring-type joints. That part of the flange not in use is exposed giving an instantaneous signal to line men showing whether the line is open or closed. The manufacturer states that practically any industry where gravity flow or pressure pipe line systems are in operation can make advantageous use of these flanges.

More information? Circle Item 48 on postcard, page 122

Centrifugal Blower Is Adaptable

The development of a new multistage, standard production centrifugal blower with extreme adaptability is announced by the Air Appliance Div., U. S. Hoffman Machinery Corp., New York, N. Y. The No. 385 frame unit is capable of delivering air volumes between 1500 and 5000 cfm, with pressures ranging from 1 to 9 lb gage, or vacuum from 2 to 12 inches hg.



Using a combination of two interchangeable impellers, the blower can be factory assembled to meet the individual needs of customers. The units are self-adapting to any variation in air volume requirements from minimum to maximum capacity. This series is of the same basic design as the company's conventional blower. This unit is the first production model available to meet any specific requirement within the given range. Units can also be equipped with impellers that import a non-overloading characteristic. The manufacturer states that there are no internal wearing parts and as a result, efficiency does not diminish with age. Rotor and housing are designed to permit free air flow, and each impeller is statically balanced. The rotating element is dynamically balanced to prevent vibration, resulting in a continuous 24-hour-a-day operation without adjustment.

More information? Circle Item 49 on postcard, page 122

(*Continued on page* 116)

POWERS AIR CONDITIONING CONTROL

Helps hasten recovery of patients

To Provide Optimum Thermal Comfort In

Operating Rooms
Recovery and Delivery Rooms
Nurseries, X-Ray
and other spaces
in hospitals —

SPECIFY and INSTALL

POWERS CONTROL

For All Types of Hospital Heating and Air Conditioning Systems

Also Thermostatic Controls for Hydrotherapy Shower Baths Water and Fuel Oil Heaters and Many Other Uses

POWERS One DEPENDABLE Source for All Hospital Requirements of

AUTOMATIC TEMPERATURE and HUMIDITY CONTROL

When you want modern controls for a new or existing building contact Powers. No other firm makes as big a variety of thermostatic controls used in hospitals. For help on any control problem call your nearest Powers office or write us direct. Our more than 60 years of experience in automatic temperature control should be helpful. (b92)

At Your Service in 60 Cities in the U.S.A., Canada and Mexico

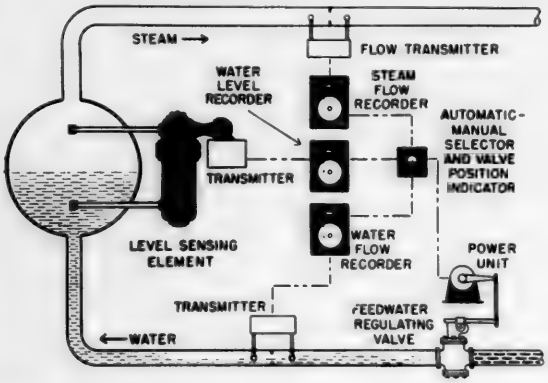
Established in 1891 • **THE POWERS REGULATOR COMPANY** • SKOKIE, ILLINOIS

(*Continued from page* 114)

Feedwater Control Systems

One, two and three element feedwater control systems are a development of The Hays Corp., Michigan City, Ind. The electronic operation of the controller provides speed of transmission and accuracy of control and is independent of effects due to normal variations in voltage and frequency.

A choice of three systems is offered to meet the requirements of large, medium or small boilers under normal or most severe operating conditions. Present instru-



ments can be utilized and pressures up to 2,500 psig can be accommodated. Shown here is the three element system which incorporates level sensing, steam flow and water flow measurement. Other features are positive valve drive (cannot freeze); operative even on cold boilers; mercury-less measuring and transmission for flow and level; direct level measurement; electronic null balance remote operation; independent adjustments for effects of steam flow, water flow and water level; no blow-down necessary.

More information? Circle Item 50 on postcard, page 122

Submersible Pump for Deep Wells

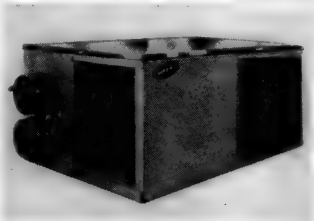
A submersible pump designed for deep wells to 280 feet, called the Peerless Dynamatic Submersible, is introduced by Peerless Pump Div., Food Machinery and Chemical Corp., Los Angeles, Calif.

The pump is designed to provide capacities up to 940 gal per hr from the shallower settings. It is available in ½, ¾, and 1 hp models. The pump consists essentially of a permanently sealed pump motor, and a multi-stage turbine pump with dynamatic impellers and smooth water passages. A construction feature of the pump is the complete protection of the electric cable of the motor by placing it inside the casing sleeve. Another of the main features is the company's 3-point bearing construction with bearing supports at the top, bottom, and middle of the multi-stage pump. Other features include non-reversing protection, impregnated synthetic electric cable, fully enclosed impeller, and a once primed-always primed feature.

More information? Circle Item 51 on postcard, page 122

Air Conditioner for Homes

A self-contained, air-cooled air conditioner for the moderate priced home is placed on the market by Shana Mfg., Inc., Chicago, Ill. The manufacturer claims that the 1½ ton unit is ideal for smaller, more inexpensive homes, as the dealer overcomes the usual water problem and the result is a less expensive installation. It will deliver 16,500 Btu per hr at ASRE conditions, and is able to operate efficiently at high outside ambient temperatures.



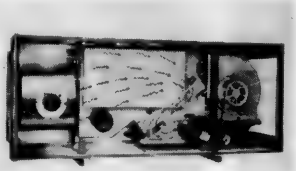
The 1½ ton unit is housed in a completely weatherproof cabinet for outdoor installation. It may be placed on the roof and has outlets for 4 round supply ducts that can run outside and drop into the ceiling. The unit also has a damper in the plenum so that the air supply may be diverted to daytime or night-time quarters, or to all the rooms at once. The unit could also be installed in conjunction with a furnace or placed in an attic or utility room and connected to the existing duct system. The air conditioner is completely self-contained, there is no refrigeration pipe to run, no water required, all in one cabinet including coils and compressor, and is factory pre-wired. The dimensions are 29 inches x 48 inches x 19¼ inches. Other features of the unit include low kilowatt input to compressor and therefore, lower operating cost; operates at 125 deg ambient temperature; unit is shipped complete with evaporator and condensing blowers; and the unit is covered by a five-year warranty.

More information? Circle Item 52 on postcard, page 122

Suspended Unit Heater

A suspended oil- or gas-fired unit heater featuring the company's Triple-pass heat exchanger is announced by Universal Products Mfg. Corp., Auburn, Ind.

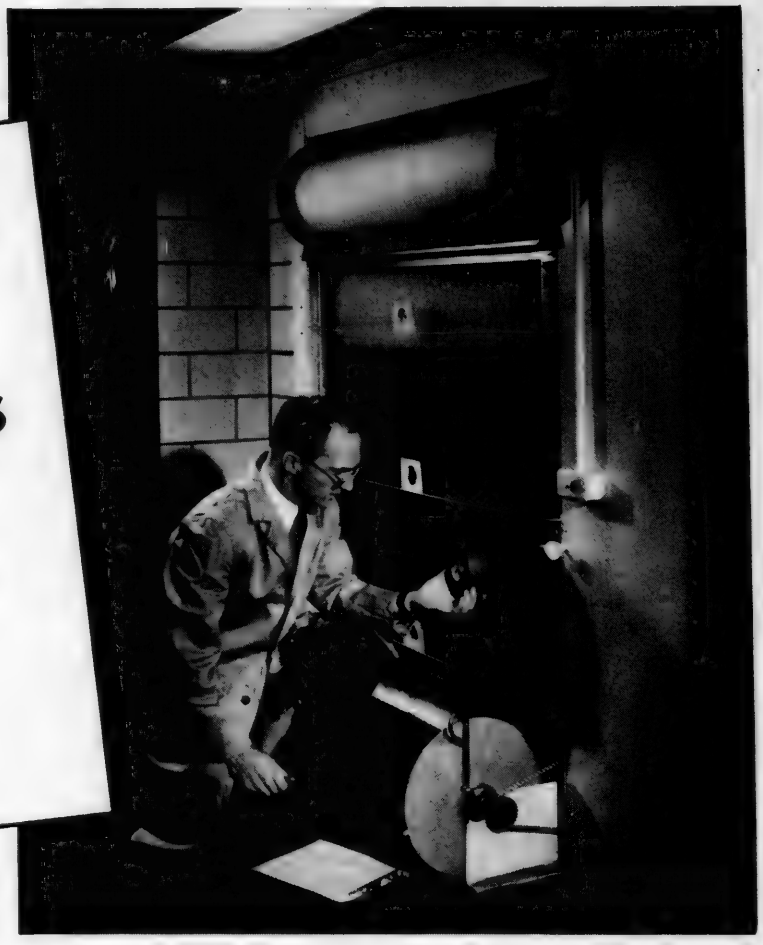
The manufacturer claims that the boiler tubes and triple pass feature create a long flue travel and provide a large amount of radiating surface which is completely wiped by the hot combustion gases. A blower forces steady delivery of a large volume of air directly over all hot surfaces and also forces a large portion of air through the boiler flues, around the heat exchanger, combustion chamber, and over both radiators. The flue outlet can be furnished either right or left side. The horizontal unit comes in six models ranging in Btu per hr output from 90,000 to 450,000 at bonnet. A feature of these units is savings in floor space as well as piping and sheet metal. The units hang overhead and save the space required for furnace or boiler installations.



More information? Circle Item 53 on postcard, page 122

(*Concluded on page* 118)

A REPORT FROM Roll-O-MATIC'S FIRST (AND TOUGHEST) CUSTOMER!



AAF General Office Building Serves as Proving Ground for New Automatic, Renewable Media Air Filter!

IT looked good on paper; was sensational in the laboratory. But how would it measure up in actual day-to-day service? AAF's General Office Building air conditioning system was selected as the "guinea pig" long before the ROLL-O-MATIC ever made a public appearance.

Never has a filter had a more critical customer. Cleaning efficiency of the bonded glass fiber "blanket" was instrument-checked regularly. Media usage was measured meticulously. Every mechanical feature was observed and evaluated under true service conditions.

After months of this "filter clinic", ROLL-O-MATIC's first customer is also its most enthusiastic. AAF engineers have positive proof of this unit's maintenance-free operation. They know that ROLL-O-MATIC can deliver clean air continuously at an operating cost less than half that of a disposable type filter of equal capacity.

Yes, ROLL-O-MATIC efficiency and cost-cutting operation is a matter of record—a record which is now being duplicated by many installations. For complete facts, contact your local AAF representative or write for Bulletin No. 248.

AAF

herman nelson

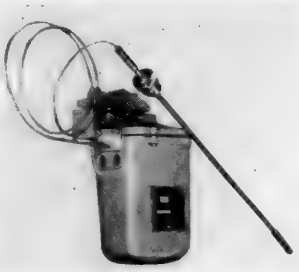
American Air Filter
COMPANY, INC.

American Air Filter of Canada, Ltd., Montreal, P. Q. • 294 Central Avenue, Louisville 8, Kentucky

(*Concluded from page* 116)

Remote Temperature Transmitter

An instrument which measures process temperatures and pneumatically transmits the information to a central recording or controlling station is announced by The Foxboro Co., Foxboro, Mass. Known as the Model 12A Temperature Transmitter, it is a nonindicating device of the force balance type with a calibrated accuracy of ½% of the temperature span and compensated for ambient temperature and barometric pressure variations.



The transmitter is designed around a gas filled thermal system which exerts force on a flapper-nozzle mechanism in proportion to the measured temperature. The resulting back pressure in the nozzle circuit, amplified through a relay and converted to a force through a bellows, balances out the initial force and constitutes the 3-15 psi output transmitted by tubing to the receiving instrument. Spans ranging from 50 to 400 deg F are available and can be utilized between the limits of —100 and +1000 deg F. Three and a half feet of Geon-protected capillary tubing connects temperature bulb to transmitter. A block and clamp mounting arrangement secures the 7-pound instrument to any vertical or horizontal pipe or to a flat surface. The instrument is weatherproof, permitting installation in hazardous or corrosive outdoor areas.

More information? Circle Item 54 on postcard, page 122

Window Air Filter Heats, Cools

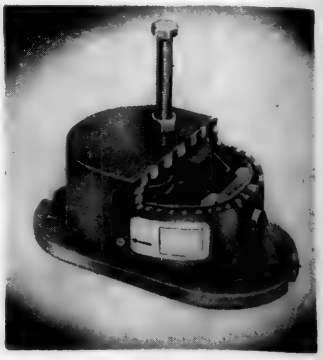
Filtered air, free from dust, pollen, and smoke, and with lowered smog and fume content, is supplied with the Therm-Aire electric window air filter manufactured by Air-Net Appliance Co. Chicago, Ill.

A highly sensitive thermo-switch operates an automatic heater and adjusts to changes in outdoor temperature, room temperature, radiator heat, and air volume. In warm weather, it brings in the cool night air and recirculates it during the day. The manufacturer states that the unit will also recirculate and refilter the room air, as a supplementary heater. The unit can be installed in any standard window. Both filters are washable, and the front filter is sprayed with medication. The thermostat arrangement causes the metal cabinet to become heated, then shuts off the coil, thus giving maximum heat radiation with minimal use of electricity. The unit is available in two models for large or small rooms with adjustable air volume and heat.

More information? Circle Item 55 on postcard, page 122

Enclosed Vibration Mountings

A fully enclosed spring type vibration isolating unit, the type SF, is placed on the market by Vibration Mountings, Inc., Elmhurst, N. Y. The unit is of telescopic construction, fully enclosed in a semi-steel housing. The steel spring mounting, with chrome vanadium springs, is claimed by the manufacturer to permit greater deflections necessary for high isolation efficiency. The units come pre-set, but may be adjusted anytime in the field.

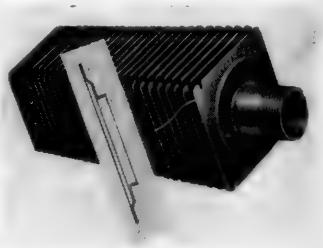


The semi-steel housing of telescopic construction provides complete enclosure of all working parts. Resilient guides contained within the upper portion of the housing are protected from floor oil drippings, dirt, and waste. These resilient guides offer all-direction snubbing and damping. Inspection windows permit checking of adjustment and operation. Complete installation and adjustment instructions are permanently affixed to each unit. Additional features include combination adjustment and leveling bolt for loading springs and leveling isolated equipment, lock nut for securing machine base, convenient anchor bolt slots, auxiliary anchor bolt holes for straddling beam web, safety bolts to prevent separation of upper and lower housings, and positive all directional snubbing and damping controls at each end. The units are suitable for punch presses, compressors, mills, engines, pumps, and similar rotating and reciprocating machinery.

More information? Circle Item 56 on postcard, page 122

Fin Collar Process Retooled

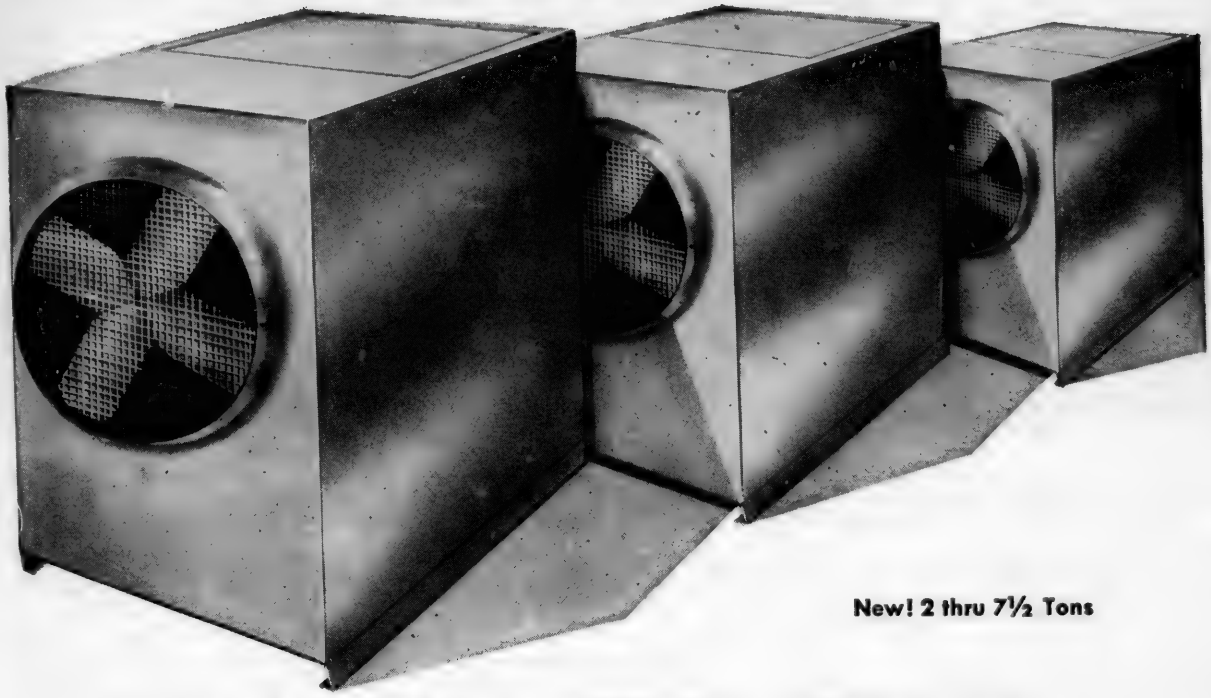
The completion of a re-tooling program which includes the development of a deep-drawn fin collar to provide intimate surface-to-surface contact between the fins and heat carrying tubes in its baseboard and commercial fin-tube products is announced by Kritzer Radiant Coils, Inc., Chicago, Ill.



The re-tooled process provides a deep collar reinforced by a clean offset in the fin, which the manufacturer claims provides enough turbulence in air flow to obtain maximum heat transfer without imposing restrictions which reduce capacity or collect dirt or dust. The fin spacing is in standard increments of 24, 32, 40 and 48 fins per lineal foot, in sizes varying from 1½ x 3 inches, to 4¼ x 4¼ inches in aluminum, copper, or steel; on copper or steel tubing in nominal sizes of ½, ¾, 1, 1¼, and 2 inches. Certified capacity ratings as high as 14 edr per lineal foot are available, when coils are used with matching enclosures.

More information? Circle Item 57 on postcard, page 122

RESIDENTIAL COOLING TOWERS



New! 2 thru 7½ Tons

ONLY HALSTEAD & MITCHELL OFFERS THE

20-Year Guarantee!

ON THE WETTED DECK SURFACE

PRICED FOR THE HOME MARKET

Price-wise these Halstead & Mitchell Residential Cooling Towers throw open huge segments of the home and small building market to air-conditioning. Here is the development for which the industry has been waiting. Check prices today!

NOW REQUIRED IN MANY AREAS

Residential Cooling Towers recirculate precious water . . . meet requirements of municipalities which prohibit wasting cooling water to sewers. And low cost H&M units take residential air conditioning to the suburbs and rural area . . . recirculate from a cistern if need be!

MADE FOR REAL OPERATING ECONOMY

Economical, lastworthy . . . low operating cost matches low initial cost. Efficient gravity-type distributing pan eliminates windage loss since atomizing by spray nozzle is unnecessary. Low pump head pressure is another bonus of gravity distribution. And maintenance is a snap!

FAMOUS HALSTEAD & MITCHELL QUALITY

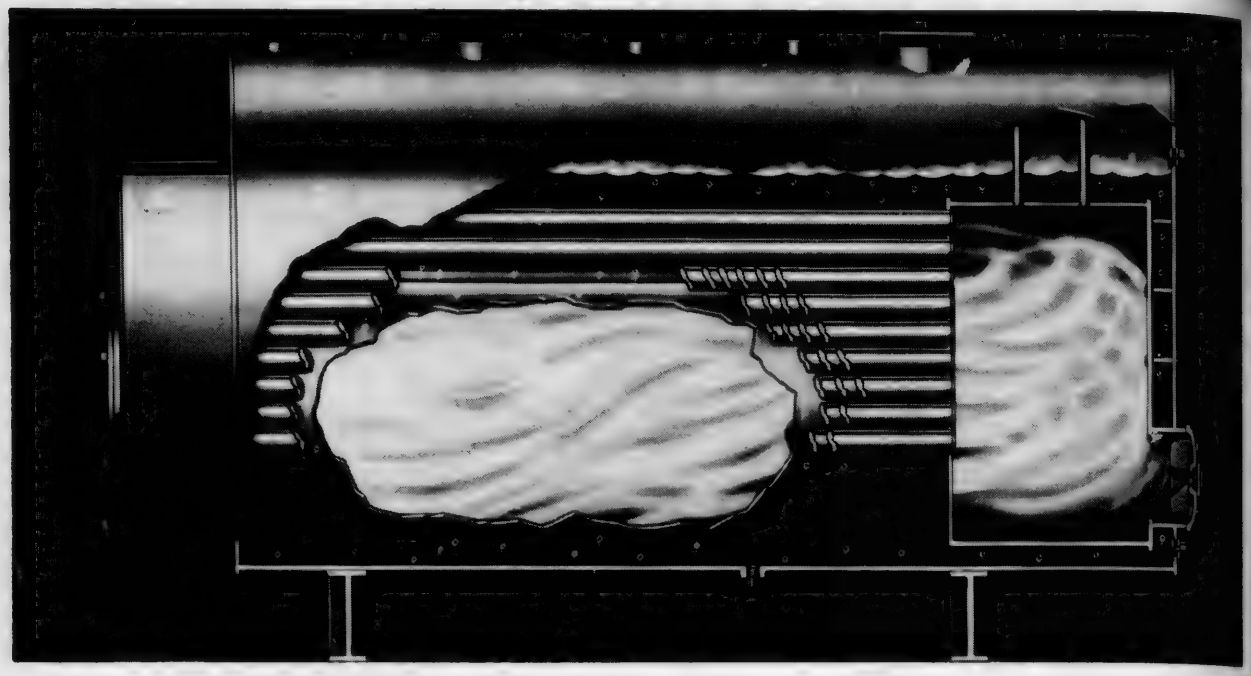
Here's *all* the quality for which Halstead & Mitchell Cooling Towers are world famous — including the 20-year Guarantee on the wetted deck surface of pressure-treated creosoted wood, against attack by rotting or fungi growth. Stainless steel fans and shafts, plus individual cabinet coatings of Vinsynite, Vinyl Zinc and chlorinated rubber add important years of life. The complete assembly is with Everdur bolts . . . disassembly is easy even after years of service.

AT LEADING WHOLESALERS EVERYWHERE

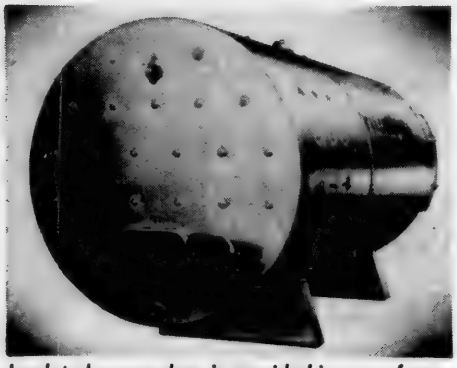
Write for descriptive bulletin from Halstead & Mitchell, one of the world's largest manufacturers of water-cooled Cleanable Condensers, and Cooling Towers up through 100-tons.

HM Halstead & Mitchell

OFFICES: BESSEMER BUILDING • PITTSBURGH 22, PA.



MORE ECONOMICAL BECAUSE IT'S *COMPLETELY* WATER-JACKETED



Insulated access door is provided in rear of combustion chamber for inspection and cleaning.

Lifting the front access door exposes all tubes for cleaning.

THE FITZGIBBONS BOILER

"Scotch Type"
saves on fuel and installation

Complete water-jacketing of *all* heating surfaces in this popular Fitzgibbons low pressure boiler means savings every step of the way—from installation to actual operation of equipment.

Specially important is the *water-cooled rear furnace wall.* This feature, not obtainable in many Scotch-type heating boilers, reduces flue gas temperatures, saves fuel, and eliminates the original expense of the usual rear dry-wall refractory lining and its high maintenance costs.

With a low water line, this boiler is ideal for locations where low headroom is a necessity or where excavation costs because of rock or water would be prohibitive.

For complete details, write to the Fitzgibbons Boiler Company, Inc., 101 Park Avenue, New York 17, N. Y. Ask for Catalog HV-12.

SBI

SINCE 1885 — MOST ECONOMICAL IN FUEL — 1896 — THE FITZGIBBONS BOILER

THE FITZGIBBONS BOILER®

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Circle the item Numbers in which you are interested and print clearly your name and address with title.

NEW CATALOGS

WELDING OF TUBULAR PRODUCTS—A folder directed toward those confronted with the task of welding stainless tubular products has been published by Tubular Products Div., Babcock & Wilcox Co., New York, N. Y. This folder, TDC 162, outlines the welding characteristics of both austenitic and ferritic grades of stainless steels and discusses the question of proper joint design. In addition, it briefly describes various welding methods such as: fusion, metallic-arc, oxyacetylene, atomic-hydrogen, inert gas arc and flash-butt welding. A table of recommended arc welding procedures is included which suggests electrodes and preheating treatment.....Item 101

BULLETIN ON AIR CONDITIONER—A bulletin, DS-303, describing its Climate Changer line has been announced by The Trane Co., La Crosse, Wis. The bulletin explains step by step how it is possible to include or omit any combination of the six phases of air conditioning with the Climate Changer.....Item 102

HAND AND FOOT VALVE CATALOG—A 20 page bulletin describing many design improvements in its 600 and 880 series of hand and foot valves has been released by Ross Operating Valve Co., Detroit, Mich. The bulletin, No. 303-B, describes the valves in detail together with installation data, parts list and exploded views of the valves to show the assembly relationship between parts. Colored air flow diagrams are also provided.....Item 103

PLUMBING SPECIALTIES CATALOG—A 52-page catalog on Streamline copper tube, solder-type fittings, and valves, is issued by Mueller Brass Co., Port Huron, Mich. The catalog, numbered S-354, contains list prices, weights, dimensions and other pertinent engineering information including roughing-in dimensions, where applicable on the company's line of plumbing products to assist wholesalers, building contractors, architects and plumbers in specifying, buying and installing these products. Special sections of the catalog are devoted to water works fittings, flanged fittings and extra heavy wrought fittings for industrial piping, wrought copper fittings for polyethylene plastic pipe and heating specialties. Other sections of the catalog contain soldering instructions and a list of tools and accessories for installing the company's pipe and fittings.....Item 104

CATALOG ON ROOF VENTILATOR LINE—An 8-page catalog showing its line of power and gravity roof ventilators has been prepared for distribution by Penn Ventilator Co., Philadelphia, Pa. Designed primarily for engineers, architects, contractors and plant maintenance men, this two-color manual contains technical data and capacity ratings with photo illustrations on propeller fan, centrifugal, stationary, rotary and ridge roof ventilators and accessories.....Item 105

CONTROLS CATALOG—A controls catalog has been released by Perfex Corp., Milwaukee, Wis. The new catalog furnishes up to date information regarding all of the company's controls and incorporates many new products, improvements and designs.....Item 106

SHOCK AND VIBRATION ISOLATORS—An 8-page brochure, Product Bulletin No. 541, describing the features and uses of its type 5200 shock and high vibration isolators is available from the manufacturer, Barry Corp., Watertown, Mass. The brochure gives information on the load ranges of the mounts as well as Graphs which give data for isolator loads, shock transmissibility, vibration transmissibility and coupled natural frequencies. Complete specification data, as well as use of the mounts in shock, vibration and shipboard application are discussed. Attachment and installation instructions are also provided.....Item 107

AUTOMATIC REGULATORS DESCRIBED—A four page bulletin No. 2 issued by Atlas Valve Co., Newark, N. J., contains illustrations and descriptive paragraphs on 12 basic control valve types frequently used by the marine and chemical process industries, power generating facilities, and for numerous liquid or gas pressure control applications requiring precise instrumentation by means of automatic regulators.....Item 108

STEAM GENERATOR DESCRIBED IN CATALOG—Its water tube type D steam generator is described in detail in a colorful 8-page catalog published by Superior Combustion Industries, Inc., New York, N. Y. The catalog gives complete data and dimensions, and is profusely illustrated to show features of construction and operation.....Item 109

BULLETIN DESCRIBES OIL BURNERS—Bulletin No. 107 on high velocity oil burners is available from Thermal Research & Engineering Corp., Conshohocken, Pa. It contains complete information including operating principles, applications and dimensions.....Item 110

PACKING SELECTOR AIDS SMALL USER—A packing selector, a cardboard disc six inches in diameter, developed by New York Belting & Packing Co., Passaic, N. J., and available free to the trade, is a speedy and accurate method of picking the right packing for a job. Shown on the circular selector are packing styles and pressure and temperature readings for the four types of packing application; gaskets, valve stems and centrifugal and reciprocating pumps. The material being handled is printed alongside a window in a second and smaller disc mounted on the larger one. The correct packing shows up in the winow alongside the material being handled as the smaller disc is rotated in accordance with the conditions of the the application. The reverse side of the wheel gives available sizes of recommended packing.....Item 111

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DATA ON AIR RELEASE VALVES—A data sheet describing three different styles of air release valves used for venting air from hot water heating systems, water mains, tanks in both deep and shallow well pumping systems, water filters and systems in water works, and for releasing air or gas from other liquid lines and tanks under pressure has been published by The V. D. Anderson Co., Cleveland, Ohio. Included in this data sheet No. 624, is a capacity table showing the cu ft of free air handled by various air release valves at different operating pressures; weights, prices and other useful purchasing information.....Item 112

PRODUCT DIGEST ISSUED—A new version of Barry's Product Digest, a four-page illustrated brochure with brief descriptions of the company's product line, is now available from Barry Corp., Watertown, Mass. The company shows all its standard isolators in the brochure, including miniature mounts for electronic gear in aircraft, shock mounts for mobile and shipboard packaging, and the Leveling Barrymounts. The brochure also lists technical articles on various aspects of shock and vibration written by company personnel, which are available to engineers upon request.....Item 113

BROCHURE ON COMBUSTIBLE GAS DEVICES—Its complete line of combustible gas analyzers and alarms are described in a 20-page brochure published by Mine Safety Appliances Co., Pittsburgh, Pa. Prepared to give details of how these instruments work, the brochure, No. 9703-3, contains part-by-part descriptions of the components of the company's analyzers. Actual installations in varied industries are fully covered, and a method of designing a combustible gas alarm system is shown schematically. Instruments to protect against most of the known combustible gases and vapors are described.....Item 114

REFRIGERATION EQUIPMENT BULLETINS—Three bulletins, describing its line of safety valves, its shell ice maker, and its finned-cooling coil, respectively, are issued by Frick Co., Waynesboro, Pa. Bulletin No. 156, covering the square finned cooling coil, describes and illustrates the coil with photographs and text. Specifications and dimensions are given as well as minimum mounting dimensions, accompanied by line drawings showing typical arrangements. Bulletin No. 54, covering the shell ice-maker, gives description, operating principle, uses and operating characteristics of the unit. The ice-maker and its shell-ice product are illustrated by the use of photographs. Bulletin No. 194-A, covering the company's line of safety valves, contains photographs, and cutaway views of the valves with full description and tables of specifications.....Item 115

DESIGN MANUAL FOR PANEL HEATING—Technical assistance on a low-cost, panel connection heating system is offered in a 24-page Design Manual for the Flexicore Split-System of Heating, issued by The Flexicore Co., Inc., Dayton, Ohio. It outlines a way to combine circulating warm air and radiant panel heat and includes suggestions for designing and controlling a single duct, double duct or reversed double duct system along with examples of typical layouts. Coverage includes simple, one-story or residential structures.....Item 116

BROCHURE DESCRIBES EVAPORATIVE CONDENSER LINE—Of interest to architects, engineers, air conditioning contractors, and industry in general, is a six-page brochure C-4.31, on redesigned, reengineered Perma-Fan line of evaporative condensers manufactured by Drayer-Hanson, Inc., Los Angeles, Calif. The brochure, illustrated with diagramatic sketches of construction highlights, also includes a large unit cutaway. The photographic cross-section is keyed and arrowed to 22 distinct sales points, separately detailed. Another section of the piece is devoted to drawings of various unit arrangements, showing a variety of right hand or left hand coil and motor connections. A table of dimensions breaks down specifications for the 14 models into chart form. A feature of the piece is a selection table.....Item 117

LEVEL CONTROL DESCRIBED—Equipment designed to provide a link between the capacitive-type electronic level-sensing equipment and the corresponding actuation of pneumatic control valves or other instrumentation is described in a new leaflet, Form CP2, issued by Thermo Instruments Co., Belmont, Calif. The literature shows in schematic form how pressure changes can either be used directly to operate a diaphragm control valve or can be fed into auxiliary automatic or manual control equipment where the pneumatic valve requires greater air volumes. An application section shows the uses of the equipment. Full specifications are included.....Item 118

BULLETIN ON PRESSURE TRANSMITTER—A bulletin on its flush diaphragm pressure transmitter is issued by The Swartwout Co., Cleveland, Ohio. The two-page bulletin, No. A-713, describes the Type P3T transmitter in detail and gives data on principles of operation. It is illustrated with cutaway view and dimensional diagram.....Item 119

GAS BURNER DESCRIBED IN BULLETIN—A bulletin, No. 177, describing its Model R, nozzle mix type gas burner has been published by Preferred Utilities Mfg. Corp., New York, N. Y. The bulletin shows photographs and sectional drawings of the unit as well as a layout of piping, accessories, and fittings. The text includes specifications, electrical characteristics, description, and lists of standard and extra equipment.....Item 120

BULLETIN GIVES BREWERY REQUIREMENTS—A bulletin, K-554, on the application of its humidity conditioning equipment to the brewery industry is issued by Kathabar Div., Surface Combustion Corp., Toledo, Ohio. Included in this illustrated, four-page, two-color bulletin are the requirements for air conditioning as set by the brewery industry. Typical installations of Kathabar equipment are described, and operation of the units is schematically illustrated. Research Foundation bacteria test photographs are included.....Item 121

TECHNICAL BULLETINS ON UNIT HEATERS—A 4-page, illustrated bulletin No. 15 entitled Piping, Trapping, and Venting Steam and Hot Water Unit Heaters is released by the Industrial Unit Heater Association, Detroit, Mich. The bulletin is designed to make the designer's and user's work easier by giving him diagrams and instructions for making the most of unit heater installations. The plant engineer is expected to find it of equal value. The majority of system applications are shown and a table of the most commonly used heat transmission coefficients is also included. Also available is Bulletin No. 12, entitled The Care and Maintenance of Steam and Hot Water Unit Heaters.....Item 122

BOOKLET ON ALUMINUM MILL PRODUCTS—A 24-page booklet containing up-to-date information on its aluminum mill products and services has been prepared by Kaiser Aluminum & Chemical Sales, Inc., Oakland, Calif. The booklet contains data on aluminum alloys, forms, properties, applications and availability. Condensed tables and charts throughout provide convenient reference material.....Item 123

BULLETIN ON SANITARY PUMP—The Sani-Flux Sanitary pump, an addition to its line of corrosion and contamination resistant pumps, is shown and described in a bulletin offered by the manufacturer, Vanton Pump & Equipment Corp., New York, N. Y. The squeegee action of its molded flexible liner is demonstrated by cutaway drawings and a schematic shows how the design simplifies d'assembly. A table of model types in capacities to 30.0 gpm is given.....Item 124

PROPERTIES OF TEFLON FIBER—A 4-page folder issued by Micromold Products Corp., Yonkers, N. Y., listing the properties of DuPont's Teflon and its applications. Standard shapes of Teflon as well as specials are included. Also attached is a handy inquiry sheet.....Item 125

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

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11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
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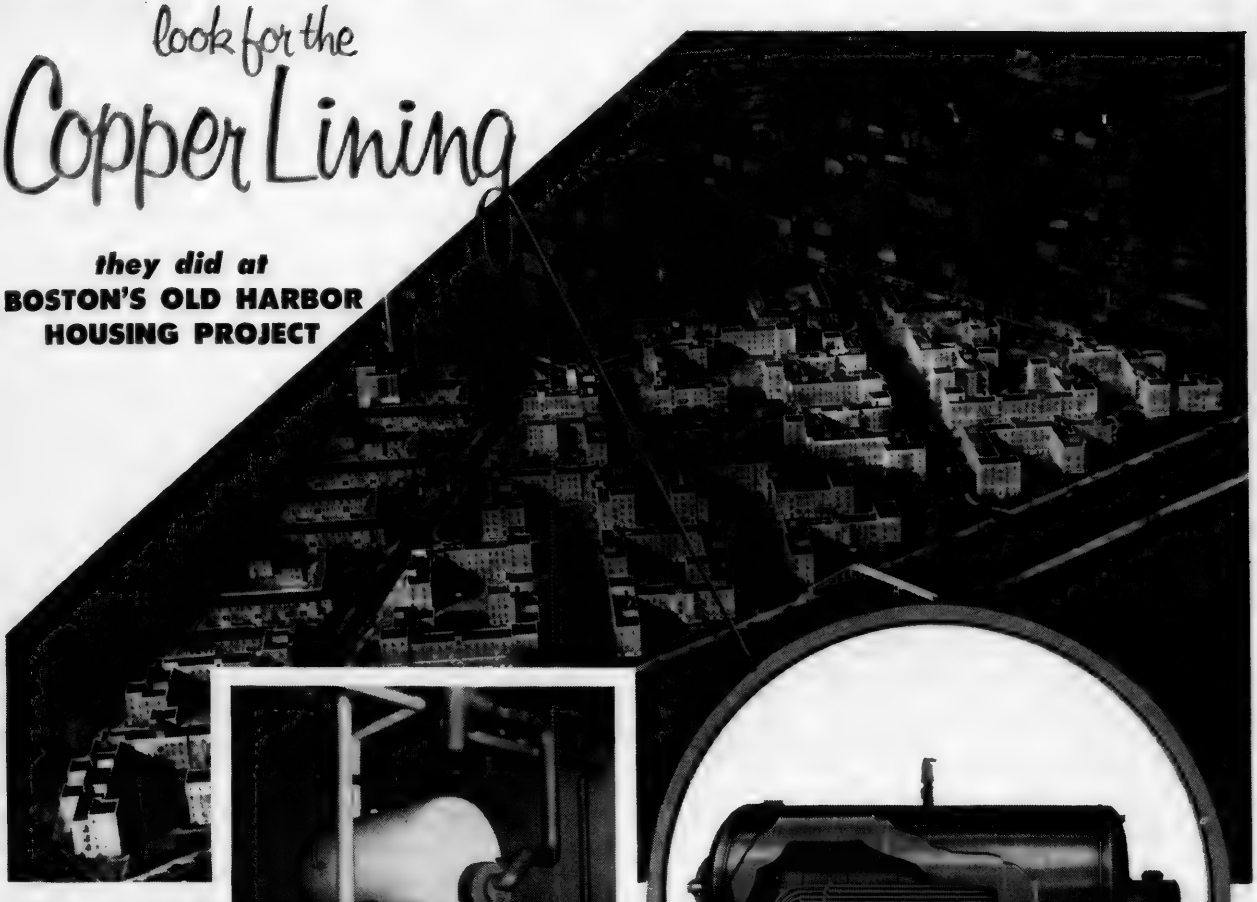
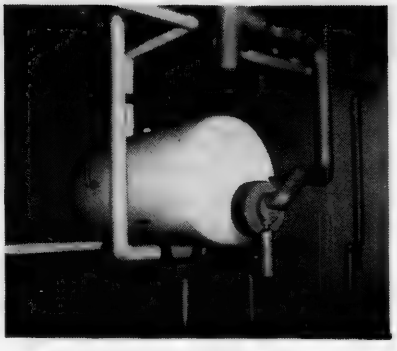
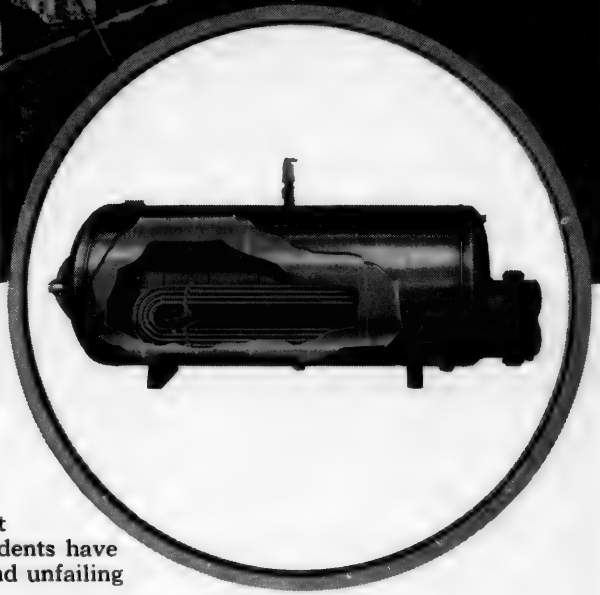
BOSTON'S OLD HARBOR HOUSING PROJECT







Old Harbor Housing Project in Boston, Mass. p-k copper-lined water heaters were installed by the M. Ahern Company, Plumbing Contractor.

In January 1937, 31 p-k copper-lined water heaters were installed at Boston's Old Harbor Housing Project. For the past 17 years, thousands of Old Harbor residents have enjoyed the benefits of an adequate and unfailing source of rust-free hot water.

Maintenance is just routine. These copper-lined heaters need no pampering. They just keep everlastingly at it. Recent inspection showed that the copper shells are still in excellent condition and are expected to stay that way for another 20 years and more.

p-k copper-lined water heaters consist of a complete copper heater built inside of a heavy steel shell—combining the non-corrosive qualities of copper with the superior strength of steel.

For trouble-free, rust-free hot water—year after year—

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PRODUCT APPLICATIONS

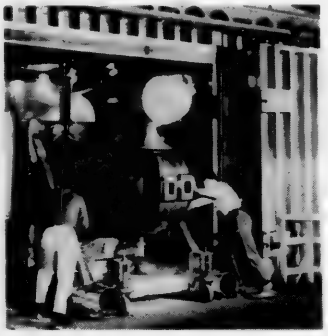
New, Unusual, or Ingenious Uses of Equipment and Materials

Conducted by WM. B. FOXHALL, Associate Editor

Test Room Cooled with Cascade System

PROBLEM: Tenney Engineering, Inc., of Union, N. J., recently completed an unusually large stratosphere chamber for the Crosley Division of Avco in Cincinnati. The enclosure measures 19 by 22 by 15 ft and was required to simulate altitudes up to 80,000 ft and to maintain temperatures at any point between —100F, and +200F.

SOLUTION: Refrigeration is supplied by a cascade system using Freon 13 in the first or low stage and Freon 12 in the second. The second stage is carried by two Frick 9-cylinder compressors with 65 hp motors. The machines operate in parallel and cool the condenser of the low stage system which is a Frick shell and tube vessel.



RESULTS: Military aviation equipment such as radar-controlled gun turrets, can be subjected to conditions simulating those to be met at the extremes of altitude and temperature.

Ohio Plant Tries Electric Heating

PROBLEM: At the Cleveland plant of the Melin Tool Company, which manufactures expendable cutting tools for use in milling machines, there was a serious need for additional floor space. The old heating system, with its big furnace, boiler, and blower fan, occupied valuable space. Even more important than the need for more floor space was the need for improved heat distribution. About half the company's 70 employees are women, who are especially suited to a production line of delicate close tolerance operations. Worker efficiency was being seriously hampered by cold spots throughout the plant. Temperatures in the factory area frequently varied as much as 15 degrees. Working conditions near metal casement windows running 10 feet high the length of the shop were especially difficult. Maintenance on the old system required janitor service and continual cleaning of combustion products which were a hazard to the company's precision power tools.

SOLUTION: President Paul Hartshorn asked the regional representative for the Electromode Corporation to compile cost figures on an electric unit heater system. Using a rule of thumb of 1 watt per cubic foot of heated area, six 10-kw electric space heaters were installed in the factory. One heater was installed in each corner of the area and two other units were hung near windows at the midpoint of the longest wall. Heaters were thus positioned at approximately 30-foot intervals, and each heater is controlled by its own thermostat. Smaller units were placed at appropriate locations throughout the plant, and office areas were equipped with both wall-mounted and portable units. The initial heating installation totaled 92 kilowatts. Soon after the system was put into operation it became evident that booster heaters would be needed to warm the plant before employees arrived in the morning. Thermostats on the six perimeter units were set back to 55 F when employees left the plant at 4 p.m. In order to bring plant temperature up 20 degrees in 2 hours, two 15-kw heaters were installed in the center of the plant. They are controlled by a time clock which turns them on at 5 a.m. and shuts them off at 7 a.m.

RESULTS: Cost figures show that, in spite of its advantage in direct fuel costs, the old system was actually costing $282 a year more than the new electric system. Employees report that the new system has contributed continually to greater accuracy in their work. There have been no complaints about heat distribution since the system was installed. Maintenance costs have been reduced by about $1,000 a year.

Air Cooled Condenser Serves Market

PROBLEM: When the Standard Grocery Company laid plans for construction of a new super market in Indianapolis, Ind., it required air conditioning but placed a premium on floor space and the use of water.

SOLUTION: A unique adaptation of the Unicon, remote type air cooled condenser manufactured by the Kramer-Trenton Company was put to use. A 10-ton air conditioning system makes the most of the space problem by utilizing two Kramer-Trenton AC-5 ceiling mounted air conditioning units with 5-ton direct expansion coils. The Brunner compressor assembly is located on the roof, with the Unicon

(*Continued on page* 126)

BARBER COLMAN

"UNI-FLO" ENGINEERED

Air Distribution

...used throughout new Oklahoma A&M Library!

Students study in comfort in this outstanding new library at Oklahoma A&M. Complete with summer-winter air conditioning, the new structure is rated as one of the finest college libraries in the nation. Air distribution throughout the building is handled by Uni-Flo equipment—ceiling diffusers as well as supply, return, and door grilles. This is the eighth building constructed in the past six years on the Oklahoma A&M campus where Barber-Colman equipment has been specified. Strong testimony, indeed, to the design, construction, dependable performance and engineered results of using modern Uni-Flo developments.

Architects: Sorey, Hill & Sorey, Oklahoma City. *College Architect:* Philip A. Wilber, Stillwater. *General Contractor:* Manhattan Construction Company, Muskogee. *Sheet Metal Contractor:* Clint Cooke Company, Oklahoma City and Stillwater, Okla.

Spacious "browsing room" with Venturi-Flo Ceiling Diffusers above, Uni-Flo Sidewall Diffusers and Return Grilles on the firred panels between windows. Each ceiling diffuser has integral volume control for simplified balancing of system.

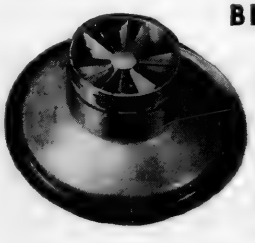
New library building at Oklahoma A&M is the pride of the Stillwater campus. It is one of the latest results of a multi-million dollar building program undertaken at the school in recent years.

Reference Room on second floor. Exceptionally quiet operation of Uni-Flo equipment makes it particularly suitable for library applications.

Reserve Reading Rooms, where Uni-Flo Sidewall Diffusers and Return Grilles in firred panels provide efficient distribution of conditioned air.

Reserve Reading Room, one of two located on first floor of library. Uni-Flo Sidewall Diffusers provide unobtrusive decorative patterns in keeping with the modern treatment of the interior . . . supply conditioned air free from draft and disturbing noise.

BLAZING THE TRAIL *TO BETTER AIR DISTRIBUTION*



First with integral volume control

Among many pioneering "firsts" accredited to Barber-Colman research is this opposed-blade type integral volume control. Linear control of volume extends from full open to shutoff. Blades are gang-operated from a single lever. The lever is hidden from sight, but easily accessible for adjusting volume. Volume control is available on all types of Barber-Colman ceiling diffusers, round or square, recessed or surface mounted. For information on this, and the dozens of other Uni-Flo "trail-blazing" features, call your nearby Field Office (consult phone directory), or write us.

BARBER-COLMAN COMPANY, Dept. L, 1102 Rock St., ROCKFORD, ILL., U.S.A.

(*Continued from page* 124)

mounted on top of the compressor housing. The two air conditioning units are suspended from the ceiling directly underneath the compressor and condenser.

RESULTS: The use of water is eliminated through application of a roof mounted air cooled condenser. Suspension of cooling units directly underneath the roof mounted compressor and condenser resulted in a minimum run of suction and liquid lines.

Church Ceiling Hides Ducts

PROBLEM: At the Druid Park Avenue Church in Augusta, Georgia, the need for air conditioning was apparent in the weather reports and in the dwindling congregration during summer Sundays. Minister Joel V. Knepper pointed out that ministers suffer especially in summer because they must wear a suit coat, perhaps over that a gown or a layer or two of vestments. In considering a conventional air conditioning installation, however, church officials realized that there was little room for duct work and that interior architecture would be adversely affected.

SOLUTION: An 11-horsepower Chrysler Airtemp packaged air conditioner was installed in the church by the Modern Roofing Co. of Augusta. The high pitched sanctuary ceiling provided an opportunity for hanging a second ceiling considerably lower behind which ducts were placed. Four diffusers in the lower ceiling distribute air throughout the church sanctuary. Return air ducts were cut in the baseboard, run up inside the wall to the between-ceilings area where they joined a trunk duct to the air conditioner. The conditioner is located in the utilty room at the rear of the church. Addtional equipment includes a water-cooling tower in the church yard and a gas-fired duct heater to provide heat through the air conditioning system in the cold weather.

RESULTS: After a year's operation, Mr. Knepper reports that warm weather attendance has definitely increased. Similarly, weekly offerings have also increased. Mr. Knepper attaches even greater importance to the fact that his message now falls upon more attentive ears.

Ice Makers Help Calm Glue Pots

PROBLEM: The job of cleaning a glue pot in which the glue has hardened may be roughly compared to that of tearing up a concrete block. The Red Lion Cabinet Company, Red Lion, Pa., was facing this problem regularly. Woodworking manufacturers commonly use a catalytic agent to speed up the setting of glue. When this is done, the glue pot must be cooled so that the glue will not set in the pot. If the temperature goes over 40 to 50 deg F, the glue will harden in the pot. The company was keeping the pots cooled by placing them in packed ice, which was purchased from an outside source and stored in a refrigerator. But since the clock works 24 hours on three shifts, they found they were unable to maintain an adequate supply.

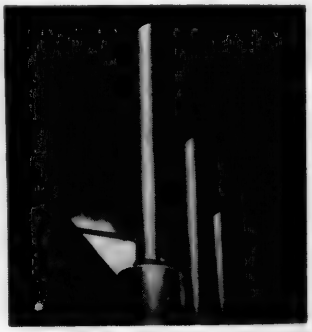
SOLUTION: The company decided to make their own ice. They purchased two Model DER-2B York FlakIce Automatic Ice Makers, These machines are small enough to be located close to the point of use and produce up to 300 pounds of ice per day or can be operated economically at a rate of 200 pounds per day.

RESULTS: The ice makers are operated 24 hours a day. Regarding their use, the plant production manager says that the ice makers have cut down lost time and increased production. The arrangement is more economical than buying ice.

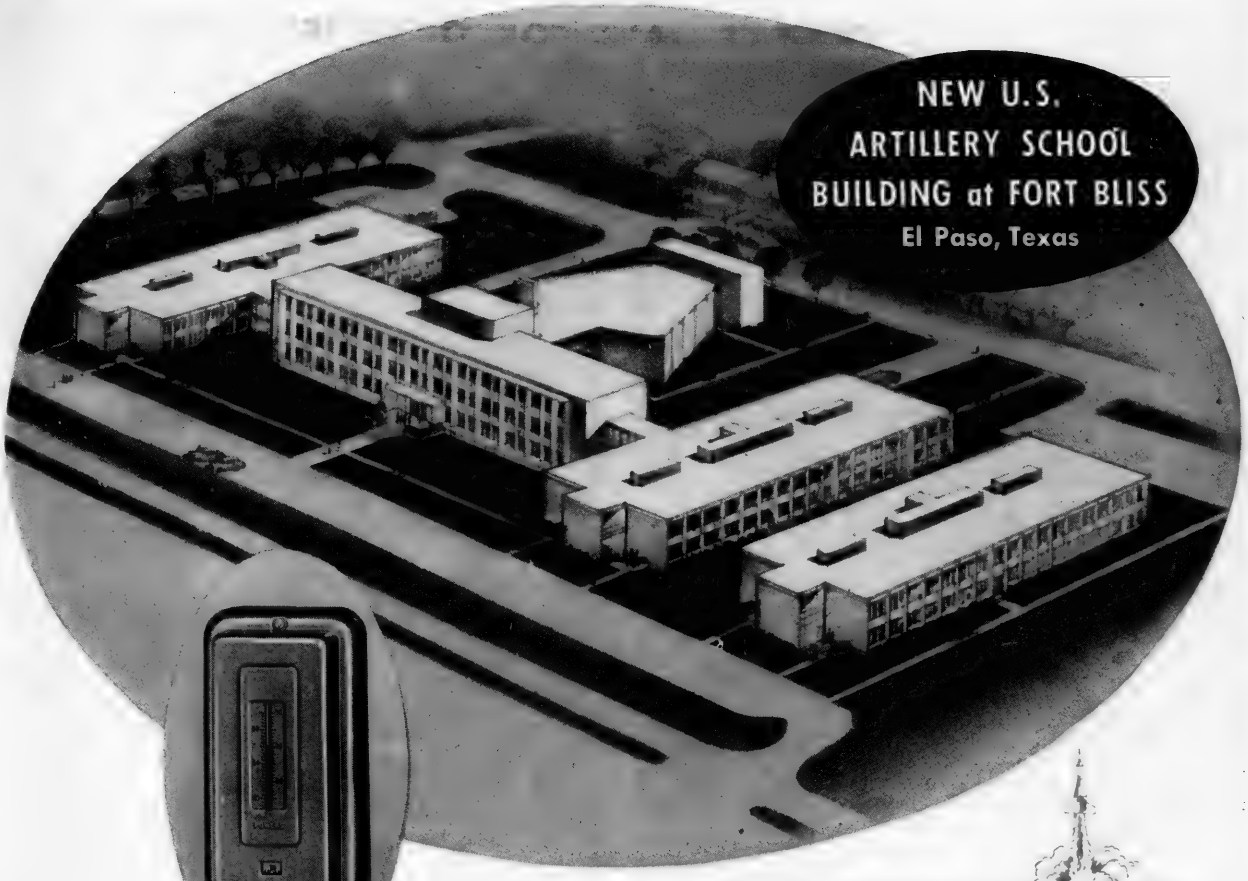
Aluminum Pigments Used in High-Heat Painting

PROBLEM: Many of the oil refinery companies in the Corpus Christi area of Texas consider a 90-day life to be standard for paint applications to diesel exhaust stacks. Reynolds Metals Co. undertook tests of methods for application of aluminum pigments for high heat painting.

SOLUTION: At the Patricio Reduction Plant of Reynolds Metals Company, the application methods selected was used on the company's Cooper-Bessemer stacks. A gray prime coat was applied to the stacks and followed by a top coating composed of a silicone resin combined with an aluminum pigment. After application of the primer coat, the diesel engines were started immediately and run for 24 hours. The engines within shut down, the aluminum silicone paint was applied, and the engnes immediately started again to bring the stacks up to full temperature. Sandblasting prior to painting proved to be the most succesful method of cleaning. Where stacks were cleaned only by wire brushing before painting, there was a tendency for the paint to spall.



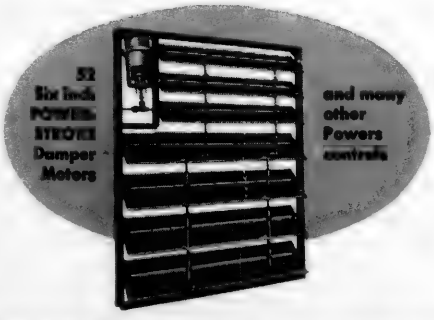
RESULTS: The application method proved so successful that all of the plant's diesel exhaust stacks were coated. After 2½ years, with the exception of a few small spots where it was necessary to do welding, the stacks have not been touched and the condition of the paint is excellent despite the fact that the normal operating temperature of these stacks is approximately 950 F with occasional intervals of 1100 F. The painting job has created considerable interest in the area, and numerous visitors have called to see the job.



Designed under the supervision of the Albuquerque District of The Corps of Engineers by Carroll & Daeuble and Landauer, Guerrero & Shafer, Architects-Engineers
General Contractors: Robert E. McKee, Inc., El Paso, Texas.
Mechanical Contractors: J. S. Brown — E. F. Olds Plumbing & Heating Co.

214 Powers Room Thermostats
Used here.

Powers **PACKLESS** Control Valves eliminate packing maintenance, leakage of water, steam or loss of vacuum



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Pneumatic System of TEMPERATURE and HUMIDITY Control

Selected for ANTI-AIRCRAFT and GUIDED MISSILES Branch of the Artillery School

TAXPAYERS will derive a big return from their investment in this huge academic building. From it will come increased strength for our defenses to hurl back and defeat aggression.

Proper temperature for maximum comfort and efficiency will be maintained in all classrooms, auditorium and administrative facilities by a Powers control system.

With over 60 years of experience, a modern complete line of controls for heating, air conditioning and industrial processes—POWERS is well qualified to help with your temperature and humidity control problems.

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(*Continued from page* 124)

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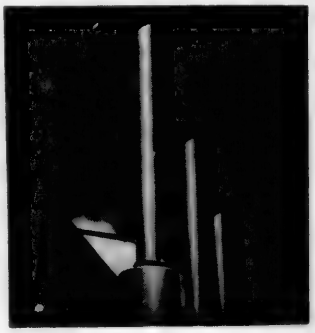
RESULTS: The ice makers are operated 24 hours a day. Regarding their use, the plant production manager says that the ice makers have cut down lost time and increased production. The arrangement is more economical than buying ice.

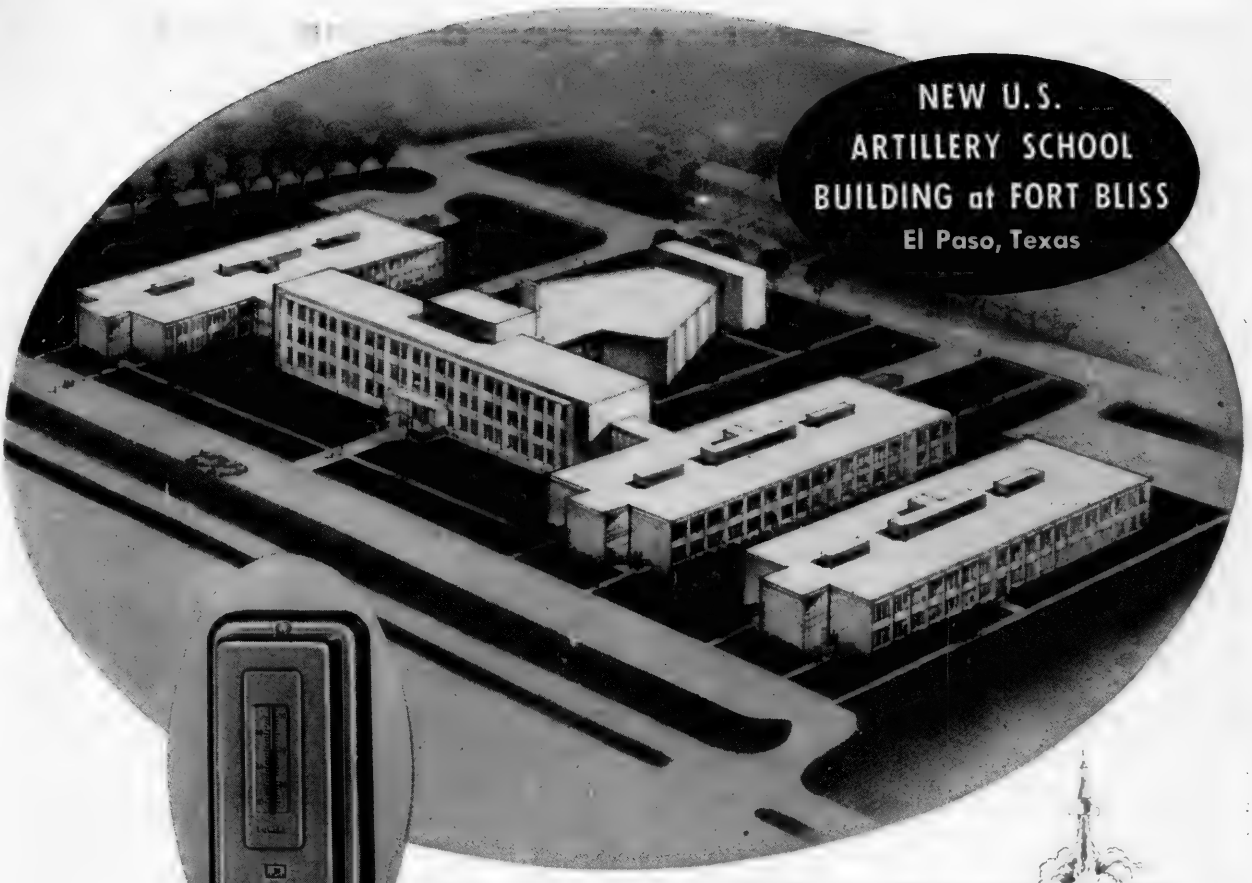
Aluminum Pigments Used in High-Heat Painting

PROBLEM: Many of the oil refinery companies in the Corpus Christi area of Texas consider a 90-day life to be standard for paint applications to diesel exhaust stacks. Reynolds Metals Co. undertook tests of methods for application of aluminum pigments for high heat painting.

SOLUTION: At the Patricio Reduction Plant of Reynolds Metals Company, the application methods selected was used on the company's Cooper-Bessemer stacks. A gray prime coat was applied to the stacks and followed by a top coating composed of a silicone resin combined with an aluminum pigment. After application of the primer coat, the diesel engines were started immediately and run for 24 hours. The engines within shut down, the aluminum silicone paint was applied, and the engnes immediately started again to bring the stacks up to full temperature. Sandblasting prior to painting proved to be the most succesful method of cleaning. Where stacks were cleaned only by wire brushing before painting, there was a tendency for the paint to spall.



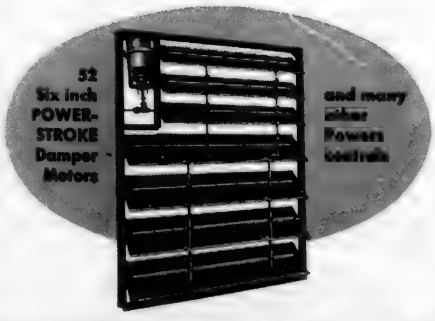
RESULTS: The application method proved so successful that all of the plant's diesel exhaust stacks were coated. After 2½ years, with the exception of a few small spots where it was necessary to do welding, the stacks have not been touched and the condition of the paint is excellent despite the fact that the normal operating temperature of these stacks is approximately 950 F with occasional intervals of 1100 F. The painting job has created considerable interest in the area, and numerous visitors have called to see the job.



Designed under the supervision of the Albuquerque District of The Corps of Engineers
by Carroll & Daeuble and Landauer, Guerrero & Shafer, Architects-Engineers
General Contractors: Robert E. McKee, Inc., El Paso, Texas.
Mechanical Contractors: J. S. Brown — E. F. Olds Plumbing & Heating Co.

214 Powers Room Thermostats
Used here.

Powers **PACKLESS** Control Valves eliminate packing maintenance, leakage of water, steam or loss of vacuum



POWERS

Pneumatic System of TEMPERATURE and HUMIDITY Control

Selected for ANTI-AIRCRAFT and GUIDED MISSILES Branch of the Artillery School

TAXPAYERS will derive a big return from their investment in this huge academic building. From it will come increased strength for our defenses to hurl back and defeat aggression.

Proper temperature for maximum comfort and efficiency will be maintained in all classrooms, auditorium and administrative facilities by a Powers control system.

With over 60 years of experience, a modern complete line of controls for heating, air conditioning and industrial processes—POWERS is well qualified to help with your temperature and humidity control problems.

(b48)

Established in 1891 • **THE POWERS REGULATOR COMPANY** • SKOKIE, ILL. • Offices in Over 50 Cities

DEGREE-DAYS FOR OCTOBER, 1954

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

HEATING AND VENTILATING's 27th Year of Publication of Monthly Degree-Day Data

City	October			Season to Oct. 31, incl.*		
	1954	1953	Normal	1954-55	1953-54	Normal
Abilene, Texas (A)	99	86	98	99	86	153
Albany, New York (A)	355	383	443	512	548	582
Albuquerque, New Mexico (A)	151	185	218	154	185	228
Alpena, Michigan (C)	489	431	530	694	668	745
Anaconda, Montana (C)	(a)	446	647**	(a)	640	982**
Asheville, North Carolina (C)	297	213	262	311	264	312
Atlanta, Georgia (A)	145	89	110	145	99	118
Atlantic City, New Jersey (C)	177	181	230	193	207	259
Augusta, Georgia (A)	143	79	59	143	79	59
Baltimore, Maryland (C)	177	130	207	179	158	236
Billings, Montana (A)	518	320	497	692	432	691
Binghamton, New York (C)	348	363	428	473	502	569
Birmingham, Alabama (A)	167	91	123	168	92	136
Bismarck, North Dakota (A)	626	401	598	877	606	825
Block Island, Rhode Island (A)	229	266	330	323	326	418
Boise, Idaho (A)	431	372	389	576	450	524
Boston, Massachusetts (A)	248	277	315	355	348	392
Bozeman, Montana (C)	(a)	477	651**	(a)	658	987**
Buffalo, New York (A)	357	328	433	489	564	555
Burlington, Iowa (A)	376	242	336	423	310	419
Burlington, Vermont (A)	427	479	521	651	678	693
Butte, Montana (C)	(a)	524	655**	(a)	734	999**
Cairo, Illinois (C)	210	127	161	213	131	189
Charleston, South Carolina (C)	68	29	34	68	29	34
Charlotte, North Carolina (A)	173	97	147	173	110	154
Chattanooga, Tennessee (A)	205	115	169	208	126	193
Cheyenne, Wyoming (A)	535	476	577	667	615	818
Chicago, Illinois (C)	302	180	326**	331	238	402**
Cincinnati, Ohio (C)	256	156	222	261	172	264
Cleveland, Ohio (A)	328	253	340	373	345	340
Columbia, Missouri (A)	286	183	262	302	208	324
Columbia, South Carolina (A)	137	55	76	137	56	76
Columbus, Ohio (C)	285	168	299	308	213	358
Concord, New Hampshire (A)	418	454	527	644	644	719
Concordia, Kansas (C)	291	182	277	309	197	332
Dallas, Texas (A)	78	54	53	78	54	53
Dayton, Ohio (A)	340	219	324	371	282	397
Deer Lodge, Montana (C)	(a)	573	733**	(a)	859	1132**
Denver, Colorado (A)	395	329	425	466	376	545
Des Moines, Iowa (A)	401	238	355	499	304	454
Detroit, Michigan (A)	350	265	381	421	367	477
Devils Lake, North Dakota (C)	658	415	654	989	681	930
Dodge City, Kansas (A)	299	182	262	314	198	302
Dubuque, Iowa (A)	467	292	444	568	442	593
Duluth, Minnesota (C)	703	477	614	1029	786	891
Elkins, West Virginia (A)	(a)	377	412	(a)	536	534
El Paso, Texas (A)	46	86	70	46	86	70
Ely, Nevada (A)	580	585	561	833	745	789
Escanaba, Michigan (C)	556	431	555	811	653	802
Evansville, Indiana (A)	289	209	215	305	232	274
Fargo, North Dakota (A)	619	381	586	865	595	801
Fort Smith, Arkansas (A)	148	113	131	149	117	140
Fort Wayne, Indiana (A)	380	257	377	424	366	484
Fort Worth, Texas (A)	77	55	58	77	55	58
Fresno, California (A)	82	107	86	82	107	86
Galveston, Texas (C)	19	7	0	19	7	0
Grand Junction, Colorado (A)	314	316	333	349	318	369
Grand Rapids, Michigan (A)	413	328	462	527	489	606
Green Bay, Wisconsin (A)	536	389	515	740	592	698
Greensboro, North Carolina (A)	230	146	202	234	170	231
Greenville, South Carolina (A)	166	87	131	166	100	141
Harrisburg, Pennsylvania (A)	281	237	308	321	303	377
Hartford, Connecticut (A)	309	309	384	439	408	485
Hatteras, North Carolina (C)	58	33	63	58	33	63
Havre, Montana (C)	566	365	564	805	533	834
Helena, Montana (A)	687	478	617	972	662	937
Houston, Texas (C)	30	15	0	30	15	0
Huron, South Dakota (A)	558	311	472	670	441	621
Indianapolis, Indiana (A)	343	231	306	373	287	385
Jackson, Mississippi (A)	116	74	69	116	74	69
Kansas City, Missouri (A)	247	151	240	254	164	284
Knoxville, Tennessee (A)	215	117	179	216	123	212
La Crosse, Wisconsin (A)	491	281	447	620	410	599
Lander, Wyoming (A)	609	476	632	747	596	876

(a) Data not available.

*Heating season, cumulative, from Sept. 1.

**Same normal figures as previously listed by HEATING AND VENTILATING since new figures are not available. All other normal figures in this table are based on a 30-year period covering 1921 to 1950, inclusive, recently compiled and published by the U. S. Weather Bureau.

Figures in this table, with eight exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y., and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company. Tacoma figures through the courtesy of the Tacoma News Tribune.

[Table concluded on page 130]

CEILING MOUNTED Type BT Cabinet, connected to duct with inlet at floor level, replaced a bulky, unattractive cast iron radiator that formerly was located below show window.

BLANKETING OPENING DOORS with a curtain of heated air, Modine Type FE Cabinet Unit protects customers and employees of this supermarket from the coldest wintry blasts.

RECESSED IN THE WALL and blending unobtrusively with the modern decor, a Modine Type BF Cabinet Unit provides economical heating, requires almost no floor space.

HARD-TO-HEAT CHURCHES offer no problems for Modine Cabinet Units. Here cold air, drawn into opening in bottom of unit, is heated and discharged through wall grille.

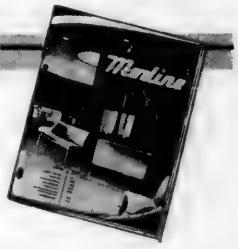
SEE YOUR HEATING JOB HERE?

Then Modine Cabinet Units are your low-cost answer!

YES, for the steam and hot water heating applications pictured above—and hundreds of others—versatile Modine Cabinet Units provide economical comfort. Quiet blower fans assure positive yet gentle circulation of heated air. Some models have provision for cooling with chilled water.

What's more, Cabinet Units' attractive appearance—plus their ability to replace at least two or three cast iron radiators—makes them ideal for new construction or modernization. If you've a difficult heating problem, get all the facts about Cabinet Units from the Modine representative listed in your classified phone book. Or mail the handy coupon at the right.

Modine
CABINET UNITS



MODINE MFG. CO.
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Please send me immediately a free copy of Bulletin describing Modine Cabinet Units.

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City .....Zn .....State .....

C-1234

Degree-Days for October, 1954 (Concluded)

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

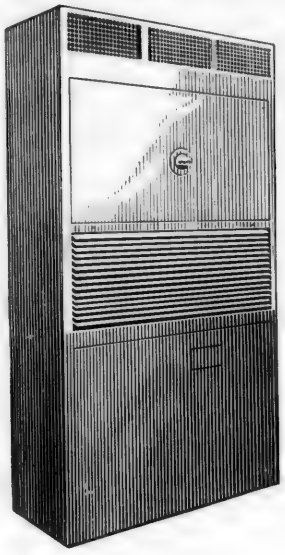
HEATING AND VENTILATING's 27th Year of Publication of Monthly Degree-Day Data

City	October			Season to Oct. 31, incl.*		
	1954	1953	Normal	1954-55	1953-54	Normal
Lansing, Michigan (A)	(a)	340	455	(a)	509	595
Lewiston, Maine (O)	437	511	501**	689	740	666**
Lincoln, Nebraska (C)	352	216	310	384	255	389
Little Rock, Arkansas (A)	142	86	110	142	86	120
Livingston, Montana (C)	(a)	436	523**	(a)	598	750**
Los Angeles, California (C)	30	16	41	30	18	58
Louisville, Kentucky (A)	280	180	232	293	201	283
Lynchburg, Virginia (A)	256	152	236	265	192	285
Macon, Georgia (A)	114	59	63	114	59	63
Madison, Wisconsin (C)	430	281	419	539	417	556
Marquette, Michigan (C)	596	385	543	881	638	779
Memphis, Tennessee (A)	(a)	114	126	(a)	115	143
Meridian, Mississippi (A)	135	80	90	135	80	90
Milwaukee, Wisconsin (A)	395	296	428	487	419	562
Minneapolis, Minnesota (A)	530	274	459	688	413	616
Moline, Illinois (A)	395	266	363	453	361	459
Montgomery, Alabama (A)	107	60	69	107	60	69
Nantucket, Massachusetts (A)	256	300	372	389	393	483
Nashville, Tennessee (A)	226	124	154	230	130	176
New Haven, Connecticut (A)	275	303	363	391	383	456
New Orleans, Louisiana (C)	33	17	5	33	17	5
New York, New York (C)	213	168	263	257	207	302
Newark, New Jersey (A)	234	195	301	287	240	348
Norfolk, Virginia (A)	145	98	152	149	105	161
North Platte, Nebraska (A)	498	340	425	515	441	545
Oak Ridge, Tennessee (C)	240	139	(a)	246	155	(a)
Oakland, California (A)	132	172	157	194	204	233
Oklahoma City, Oklahoma (A)	153	132	149	153	132	161
Omaha, Nebraska (A)	359	209	331	395	249	419
Parkersburg, West Virginia (C)	(a)	215	272	(a)	265	328
Peoria, Illinois (A)	344	231	339	380	293	425
Philadelphia, Pennsylvania (C)	198	132	219	216	161	252
Phoenix, Arizona (A)	14	11	13	14	11	13
Pittsburgh, Pennsylvania (C)	298	224	298	324	281	354
Pocatello, Idaho (A)	568	448	487	749	535	670
Portland, Maine (A)	424	461	515	679	687	714
Portland, Oregon (C)	285	236	280	382	296	365
Providence, Rhode Island (A)	284	340	381	402	458	488
Pueblo, Colorado (A)	341	300	383	369	329	457
Raleigh, North Carolina (A)	201	98	118	202	105	128
Rapid City, South Dakota (A)	562	296	500	672	405	693
Reading, Pennsylvania (C)	252	191	285	288	244	342
Red Bluff, California (A)	68	83	59	74	83	59
Reno, Nevada (A)	470	485	443	687	552	608
Richmond, Virginia (A)	220	152	210	225	180	243
Rochester, New York (A)	359	367	440	516	519	573
Roswell, New Mexico (A)	170	165	156	170	165	164
Sacramento, California (C)	77	86	75	81	86	92
St. Joseph, Missouri (A)	291	208	233	312	235	282
St. Louis, Missouri (C)	258	143	202	269	153	240
Salt Lake City, Utah (A)	399	341	381	492	369	469
San Antonio, Texas (A)	29	15	25	29	15	25
San Diego, California (A)	35	15	52	35	18	76
Sandusky, Ohio (C)	114	123	128	232	211	238
San Francisco, California (C)	306	231	327	334	302	393
Sault Ste. Marie, Michigan (A)	622	485	639	944	818	937
Savannah, Georgia, (A)	107	45	38	107	45	38
Scranton, Pennsylvania (C)	336	316	389	437	433	504
Seattle, Washington (C)	349	278	329	478	382	463
Sheridan, Wyoming (A)	589	395	578	757	534	817
Shreveport, Louisiana (A)	81	54	53	81	54	53
Sioux City, Iowa (A)	444	259	405	509	350	533
Spokane, Washington (A)	574	409	508	800	558	713
Springfield, Illinois (A)	332	178	259	365	209	315
Springfield, Missouri (A)	268	175	249	279	188	310
Syracuse, New York (A)	331	369	396	469	503	513
Tacoma, Washington (C)	379	303	375	504	414	552
Terre Haute, Indiana (A)	(a)	217	295	(a)	271	372
Toledo, Ohio (A)	374	283	387	432	392	489
Topeka, Kansas (C)	255	158	242	268	172	284
Trenton, New Jersey (C)	244	200	285	289	254	340
Utica, New York (O)	375	386	430**	556	551	612**
Valentine, Nebraska (C)	532	291	461	646	398	606
Walla Walla, Washington (C)	389	251	308	466	287	401
Washington, D. C. (C)	218	128	231	226	156	263
Wichita, Kansas (A)	223	159	219	226	168	251
Williston, North Dakota (C)	603	391	605	907	611	866
Winnemucca, Nevada (A)	539	514	508	799	614	688
Yakima, Washington (A)	535	401	446	701	503	596

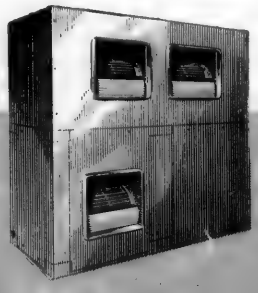
For footnotes, see page 140.

There's money in the air...
when you sell **CHRYSLER AIRTEMP!**

"Packaged" Water-Cooled Air Conditioners in 6 models, from 2 to 15 H.P.



"Packaged" Waterless Air Conditioners—no water needed, no plumbing required. 2, 3, 5 and 7½ H.P.



do you want to make more profit?

HERE'S HOW TO REDUCE INSTALLATION COST!

Chrysler Airtemp "Packaged" Air Conditioners are so quiet in operation they can be put in or near the conditioned area—saving ductwork and wiring. You can easily split a unit when need arises. Air-cooled models don't need water savers or plumbing.

Here are factors that make for easier, faster installation—to reduce your costs and increase your profit.
But the Chrysler Airtemp "Packaged" Cooling Franchise is your best choice today for other reasons, too.
Get the complete facts—write Airtemp Division, Chrysler Corporation, Dayton 1, Ohio.

AIRTEMP
DIVISION OF CHRYSLER

Air Conditioning's other name... *Chrysler Airtemp*

AIR CONDITIONING • HEATING FOR HOMES, BUSINESS AND INDUSTRY

NEWS OF THE MONTH

NEW DEVELOPMENT

in metals is expected to find application in many industries dealing with heat tarnsfer.

A new development in metals, which its manufacturer expects to cut die costs in many industries concerned with temperature control, has been made public by Olin Mathieson Chemical Corp., New York, N. Y. The process is a new application of the old art of roll bonding, whereby any pattern of tubing can be created within a single homogeneous sheet of metal. The development is expected to find application in such fields as home construction, air conditioning, insulation, heating, aviation, automotive and other industries concerned with heat exchange. The process has already been used commercially in the refrigeration industry, where roll bonded evaporator plates have been produced in the company's pilot plant for a major refrigerator manufacturer who is thus able to install a one-piece freezing compartment.

● **PROCESS.**—To produce tubing within a single homogeneous sheet of metal for, as an example, refrigerator evaporator plates, two flat pieces of aluminum or copper are first cut to size and cleaned. Then the pattern that will become tubing and other passages is applied to one of the flat sheets by means of a silk screen process. This involves placing the pattern to be reproduced on special silk stretched tightly on a frame so that the pattern becomes the porous part of the screen. The "paint" used to apply the pattern is a combination of ink normally used for silk screen and a stop-weld material that prevents the surface painted with it from bonding to another piece of metal under heat and pressure. After the stop-weld pattern is applied to the metal through the silk screen by means of a rubber roller, the two sheets are placed face-to-face to form a metal "sandwich," and spot welded on the corners to keep them together in the proper relative positions.

The metal "sandwich" is then heated and rolled as shown in Fig. 1. The first hot rollings produce a complete bond, and subsequent cold rollings reduce the now homogeneous sheet of metal to proper thickness. As rolling operations elongate the pattern several times, the key to the success of the operation is to pre-plan a silk screen pattern which, when elongated, will result in properly proportioned patterns. After roll-bonding, the metal, which has completely fused except where the stop-weld was applied, is annealed to render it less brittle. Then, one end of the elongated plate is trimmed to bare the lead-in end of the stop-weld pattern. A needle, much like that used to inflate a football, is inserted in the bared end. The plate is placed securely between two platens of a hydraulic press, and hydraulic pressure is applied through the needle to inflate the stop-weld pattern. Areas where the stop-weld has been applied become passageways which are an integral part of the metal. The final step is to flush out and clean the passageways (Fig. 2) to remove the stop-weld. The sheet is then thoroughly dried internally, and trimmed to size.

Fig. 1. Aluminum "sandwiches," with stop-weld pattern between the two plates, enters furnace on way to first hot rolling.

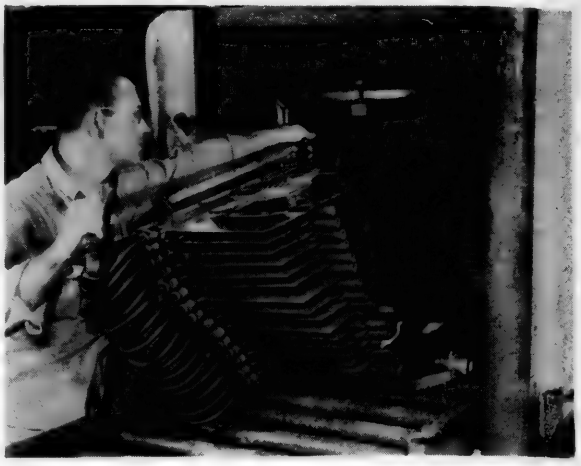


Fig. 2. The finished evaporator plates are flushed internally to remove all traces of stop-weld material.

● **APPLICATIONS.**—The finished sheet and tube, as shown in Fig. 3, is a single homogeneous sheet of metal, with no voids, solder, or foreign material to serve as a barrier against heat conduction. This feature, combined with flexibility of design, lighter weight, and reduced costs, indicate the potential applications of the product to be many and varied with important emphasis in the heating and cooling field.

Solar heating is one application now being explored in experiments being conducted by Massachusetts Institute of Technology. The experiment involves the use of a roof made of roll bonded sheets, where water within the tubing is heated by the rays of the sun. Hot water is then drawn through the house within the passageways of roll bonded walls, ceilings, and floors. Used as prefabricated sections, roll bonded panels could be used for walls, doors, roofs, or the entire side wall of a house. Besides adding struc-

(*Continued on page* 134)

EXPANDED

CHICAGO'S

Enlarged Line of

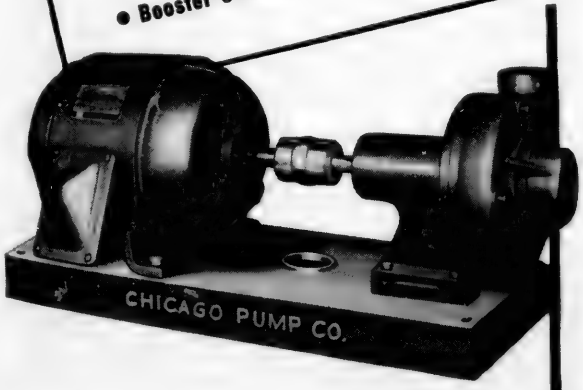
FC FLEXIBLE-COUPLED and CC CLOSE-COUPLED Pumps

Gives You More Choices, More Efficiency

Models for

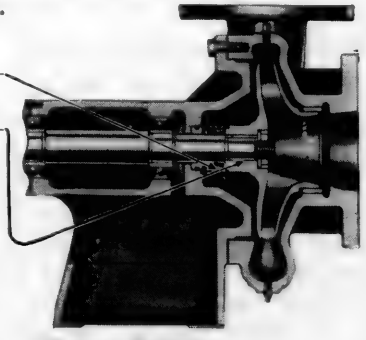
- Water Supply Systems
- Cooling Tower Circulating
- Air Conditioning Systems
- Hot and Chilled Water Circulating
- Pneumatic Water Systems
- Booster Service

However specialized your need for a circulating pump, you are sure to find the model and size that exactly fits your requirements in Chicago's recently expanded centrifugal pump line. Now you can get high efficiency Chicago Pumps in either close-coupled or flexible-coupled models with capacities from 5 to 400 G.P.M. and for heads from 10 to 190 feet. Complete line is described in two new bulletins, Nos. 107 and 108. Write for free copies.



FEATURING THE CERAMIC-FACED SEAL AND SHORT OVERHANG IMPELLER

All Chicago C-C and F-C Pumps are equipped with the most reliable mechanical seal ever built into a pump! Ceramic-faced stationary seat is highly resistant to wear. Accurately lapped surfaces and automatic adjustment for wear assures long life under strenuous service. No troublesome packing replacement and maintenance, no shaft wear commonly found with stuffing box seals.



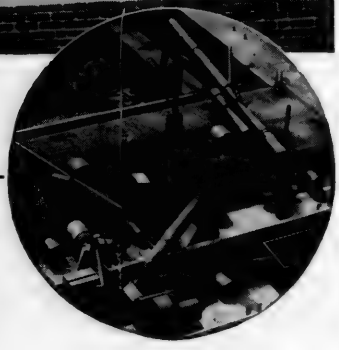
Silence Built-In

Ball bearings close to the end of the impeller insure ample support and alignment for quiet operation *always*. Impeller is perfectly balanced for vibrationless, noiseless rotation.

CHICAGO PUMP COMPANY

Subsidiary of Food Machinery and Chemical Corporation

BUILDING and INDUSTRIAL DIVISION



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-------AIR--------
For a Supersonic
WIND TUNNEL

● New and improved, this NIAGARA METHOD that effectively dries outdoor air for a wind tunnel used for testing at supersonic speed, can be trusted to give you the best air conditions for your purpose:

- **to dry your materials or products**
- **to prevent condensation or moisture damage**
- **to protect your moisture-sensitive processes**
- **to give you an atmosphere in which your product can be packaged or stored safely**
- **to give you exactly the right atmospheric conditions for testing materials**
- **to put "fresh air" back into your air conditioning, increasing its capacity and effectiveness**

The Niagara "fresh air" Method removes the excess moisture from outdoor air by contact with an absorbent liquid in a spray chamber. The liquid contact temperature and the absorbent concentration, both controlled thermostatically, determine the amount of moisture in the conditioned air. Heating or cooling the air is a separate function. Therefore, you can easily and inexpensively have a precisely controlled condition without the use of moisture sensitive instruments.

The Niagara Absorbent Spray Method is noted for solving the really difficult problems of air conditioning. Write for complete information.

NIAGARA BLOWER COMPANY

Over 35 Years of Service in Industrial Air Engineering

Dept. HV, 405 Lexington Ave. New York 17, N. Y.

Field Engineers in Principal Cities of U. S. and Canada

NEW DEVELOPMENT

(*Continued from page* 132)

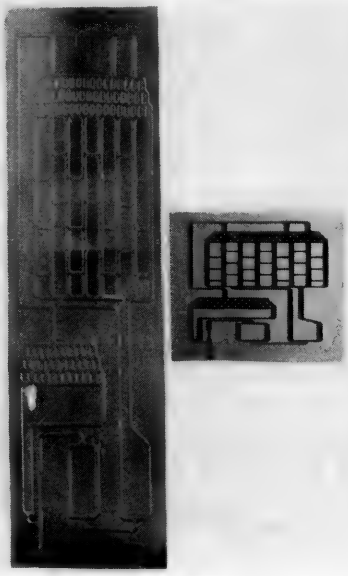


Fig. 3. In the photo above, a finished evaporator plate is shown (lower), and half of the metal "sandwich" from which it was made (upper).

tural strength, large air spaces or small passageways within the metal could serve as insulation, wiring conduits, or conduct heating or cooling agents.

Inexpensive, small size air conditioning is a definite possibility using the new process. Cost reductions would come from less expensive production equipment and lower priced evaporators. With the process, it is possible to build the header or accumulator right into the design of the evaporator, reducing weight and resistance to conduction, and eliminating bonds and the cost of a separate attachment.

Roll bonded pillows are now being tested for oven and refrigerator insulation. If successful, less expensive insulating materials could be used. Cost would be lower and more storage space would be provided.

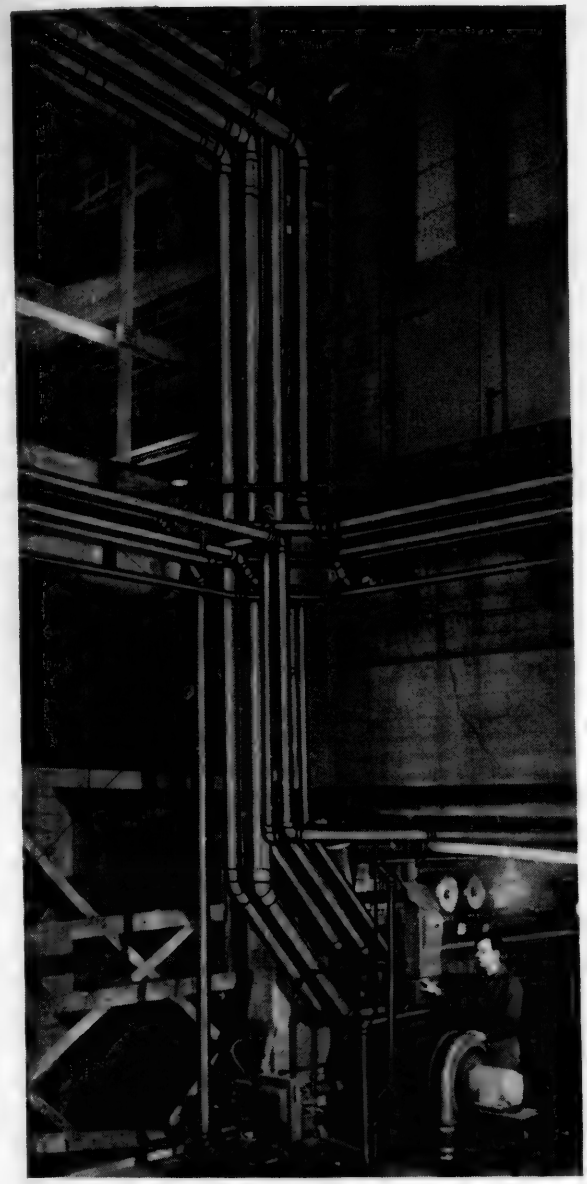
● **PRODUCTION.**—The company has already begun construction of a multi-million dollar plant to put the new process on a mass production basis for industry. Huntly Campbell, general manager of the company's Metals Division, states that the plant will be completed and in production within a year.

SOLAR ENERGY

explored for possible commercial utilization at annual conference of national organization.

A special feature of the third annual conference of the National Industrial Conference Board, Inc., in recognition of the rapid progress being made toward the com-

(*Continued on page* 136)



BOILER ROOM of new Ste. Justine Hospital, Montreal, Canada. Architect, Joseph Sawyer. Associate architect, Henri S. Labelle. Consulting engineers, Leblanc & Montpetit. Distributor, James Robertson Co., Ltd. All the above firms are located in Montreal, as is the Industrial Plumbing & Heating Co., Ltd. who made the installation.

SHOWN ABOVE are 8" Type K water main, 6" fire main and two 6" hot water lines. Note tubes do not touch steel support. They rest on copper strip welded on U-shape support.

6" and 8" Water Mains of Anaconda Copper Tube installed in new hospital

Copper's non-rusting and corrosion-resistant properties assure long piping life, low maintenance costs

All hot and cold water lines in Montreal's new multi-million-dollar Ste. Justine Hospital are Type "K" Copper Tube. The installation includes 8" tube for the main supply line and 6" tube for the mains serving the hot water system and fire protection lines.

Industrial Plumbing and Heating Co., Ltd., Montreal, who made the installation, has this to say about copper:

"...proved most economical piping material because of complicated layout...made the installation in much less time than it would have taken with pipelines requiring threaded connections...longer lengths meant fewer fittings...solder-type fittings made quickly...easy to handle because of light weight...smaller sizes bent right on the job...able to make connections in close quarters where a threaded assembly would be impossible..."

All these are good reasons why you can make big savings on installation costs when you use ANACONDA Copper Tubes.

Operating costs are less, too. The smooth, rust-free interior surface means lower pumping costs. The ease of dismantling and reassembling copper tube lines to meet changing piping requirements saves money and keeps costly shutdown time to a minimum.

If our Technical Department can be of assistance in helping you solve a piping problem, don't hesitate to call on them. The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 4447

for copper piping call an

ANACONDA®

DISTRIBUTOR

We do utilize all the principal vibration control media because we believe each has its place, either alone or in combination in controlling vibration problems. We don't think one product, or even one type of product can solve all vibration problems efficiently and economically.

During our half-century of experience we've come up against *and solved* almost every imaginable type of vibration problem. And, we've corrected enough faulty vibration control installations to know that each problem is unique in itself. There is no panacea. A single product cannot solve *all* problems.

So when you have a problem, bring it to Korfund—the pioneer in the field of engineered vibration control. You'll get impartial recommendations on media, whether it be springs, rubber, or cork, alone or in combination. Our experience will tell us which is best for you. And after all, there is no substitute for experience.

For your free equipment isolation Selector Chart and additional data on increasing production and reducing costs, write for your copy of Bulletin 25, or see our catalog in Sweet's Files.

See us at Booth 548 Air Conditioning Show Philadelphia January 24-28

For specific recommendations, contact us or your local Korfund office. Look under "Korfund" in your local Telephone Directory or in Thomas' Register. A half-century of experience is at your disposal.

THE KORFUND CO., INC.

KORFUND VIBRATION CONTROL SPRINGS RUBBER CORK

48-01E Thirty Second Place, Long Island City 1, N. Y.
In Canada: 510 Canal Bank, Ville St. Pierre, Montreal

SOLAR ENERGY

(*Continued from page* 134)

mercial use of solar energy and the impact it could have on atomic and the older energy sources, was a panel discussion on solar energy. The panel on commercial utilization of solar energy included talks by noted individuals in this embryonic field, and embraced such topics as the prospects for solar energy utilization, sun power from reflectors, future uses of solar energy, photochemical and photogalvanic utilization of light energy, and an interesting discussion of the improvements made on the Bell Solar Battery, since its introduction five months ago.

• **AVAILABLE RADIATION.**—In a discussion of sun power from reflectors, Charles G. Abbot of the Smithsonian Institute observed that a first consideration in regarding power from solar radiation is an estimate of how much radiation is available. Citing Smithsonian Institute figures, compiled from fifty years of measuring solar radiation, Mr. Abbot declared that 430 Btu per sq ft per hr, or thirty times the power used at present for all purposes in the United States could be tapped from the sun's rays. Mr. Abbot claimed "a world-wide demand for small solar power machines up to 5 hp, for irrigation, heating and cooling of dwellings, charging batteries, and other ranch uses," and expressed a desire to see a pilot plant of engineering scale tried out in field conditions.

• **SOLAR STOVE.**— Dr. Maria Telkes, speaking on the future uses of solar energy, predicted that small household appliances using the sun's energy will be in fairly wide-spread use within the next five years, particularly in tropical regions, where conventional fuels are at a premium and small devices powered by the sun could provide a substantially increased standard of living. Dr. Telkes noted that one such device, a solar stove, is undergoing active research and development in New York University's Engineering Research Division where she is Projects Director. "Small cooling units utilizing the sun's energy are also feasible," said Dr. Telkes. Introduction of cheap and convenient cooling systems "could conceivably bring a significant rise in the level of biological capacity for productive activity in many areas." Dr. Telkes also called for wider development of solar power, stating that depletion of conventional fuels in some areas, and increasing consumption in others, has already created a need for large-scale solar energy development.

• **SOLAR BATTERY.**—In a talk on the Bell Solar Battery, a silicon p-n junction photovoltaic device, Gerald L. Pearson, co-inventor of the device, announced that his colleagues at Bell Telephone Laboratories have now built experimental cells which yield a record 8% efficiency, or ten to fifteen times better than the best photovoltaic devices available. "The Bell Solar Battery is a relatively new device, and still in the research stage," Mr. Pearson pointed out, "but small solar converters like those now produced experimentally could be extremely useful for communication purposes where the power requirements are small. He continued, saying that research indicates the batteries could be used as power suppliers for low-power portable equipment, or as sun-powered battery chargers for amplifier stations on telephone lines. The illustration

(*Continued on page* 138)

G.E. HAS THE ANSWER TO AIR CONDITIONING PROBLEMS IN ANY OFFICE, STORE, OR FACTORY

Church is completely air conditioned without ducts or structural changes

G-E climate survey suggests simple and efficient installation that does not detract from formal simplicity of church interior.

You'll have to look hard to find any signs of air conditioning in this reposed Kansas City, Missouri, church interior. The installation consists of four 10-ton General Electric Packaged Air Conditioners enclosed in housings *outside* the stained glass windows. This effective means of air conditioning a large space was proposed by Air Contractors, Inc., local G-E contractors, after a thorough heat-gain and heat-loss survey of the church structure. Installed early this year these units handled a July-August attendance increase of 24% effectively, quietly and economically.

CHECK THESE ADVANTAGES OF G-E PACKAGED AIR CONDITIONING

- Low installation and operating costs.
- Easily directed air flow for no-draft, no-waste air circulation.
- Maximum design freedom—use in space or concealed, with or without ducts.
- Streamlined styling blends with any decor.
- 3, 5, 7½, 10 and 15 ton units in single or multiple for buildings of any size.
- Muggy Weather Control removes excess moisture without over-chilling.
- G-E factory assembled. 5-year warranty covers entire sealed cooling system.

Write for complete architectural data.

GENERAL ELECTRIC COMPANY
COMMERCIAL & INDUSTRIAL AIR CONDITIONING DEPT., BLOOMFIELD, N. J.

Packaged AIR CONDITIONERS

Progress Is Our Most Important Product

GENERAL ELECTRIC

For combustion testing in the field!

HAYS ORSAT TYPE GAS ANALYZER

The first of its type developed for field work, the Hays Analyzer answers the need for an Orsat type gas analyzer husky enough for use in the boiler room and for installation and service work in commercial and home heating plants, yet simple, fast and accurate!

It's Rugged—**Made with strong pressed steel, the Hays Orsat is designed for continuous boiler room operation and field work . . . takes wear and tear in stride!**

It's Portable—**The Hays Orsat contains everything needed for *complete* analysis (CO_2, O_2, CO) in one light (only 8 lbs.), easy-to-carry case . . . goes wherever it's needed. Compact, with all parts easily accessible.**

Available in one, two or three unit styles. Does a complete testing job for CO_2, O_2 and CO in 3 minutes!

Send for publication 54-668-27—a complete description of all styles.

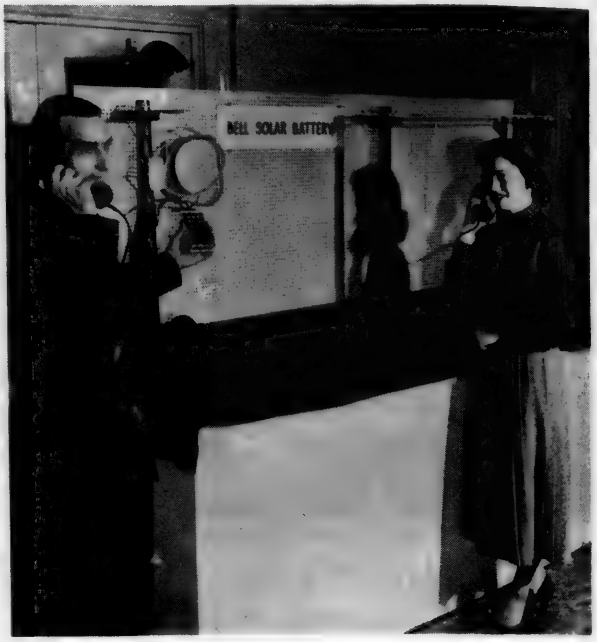
Automatic Combustion Control
Boiler Panels • CO_2 Recorders
Veriflow Meters and Veritrol
Gas Analyzers • Draft Gages
Combustion Test Sets
Electronic Oxygen Recorders
Electronic Flowmeters
Electronic Feed Water Controls
Miniature Remote Indicators

THE hays CORPORATION

MICHIGAN CITY 26, INDIANA

SOLAR ENERGY

(*Continued from page* 136)



The power needed to transmit a telephone conversation can now be obtained directly from the sun using Bell Telephone's Solar Battery

above, shows the device being held under artificial light to demonstrate its ability to supply the power needed to transmit a telephone conversation.

• **CONVERSION METHODS.**— Professor Hoyt C. Hottel of Massachusetts Institute of Technology reviewed the present modes of converting solar energy to useful applications. He pointed out that three principles are used: (1) Direct photo-electric conversion of light quanta, as in the Pearson battery; (2) photosynthetic storage methods, as in the algae culture studies of Carnegie Institute and Arthur D. Little Co.; and (3) heat collector methods, both flat plate and focusing. Of the three, according to Professor Hottel, heat collector methods are most practical, as of now, for large scale energy uses, even though they are a thermodynamic degradation of the actual energy in the sun's rays.

ATOMIC POWER

conference held by industrial organization to review developments toward peacetime use.

Bringing together the leaders of industry, science, and government, the third annual conference of the National Industrial Conference Board, Inc., met in New York recently to discuss the promises and problems of the nonmilitary uses of atomic energy. This year's conference reviewed the status of atomic energy in the United States,

(*Continued on page* 144)

HEATING AND VENTILATING'S *Ad-Digest* SERVICE

Below and on the following pages are given brief digests of the advertisements appearing in this month's issue. Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail the prepaid postcard to request further information from manufacturers.

NOTE: While every attempt is made to list all advertisements, those which are received after the published closing date may not appear. The Index of Advertisers lists all the advertisements in this issue.

TRAPS. Page 143. A float and thermostatic trap with which repeat orders are the rule because of its absolutely dependable, trouble-free performance in removing all air and condensate from steam mains, branches, risers, unit heaters, coils, and similar equipment. Catalog available. ----------Item 201

TANK DRAIN. Page 32. A tank drain for hot water expansion tanks not so equipped. This drain makes the draining of water-logged expansion tanks simple, quick and positive. Information available...Item 202

AIR CONDITIONING EQUIPMENT. Page 14. This line includes room air conditioners, packaged units, residential cooling and heating units, evaporative condensers and condensing units. Every product is built with quality material and workmanship. With this line you can handle any installation for home, office, store or factory. Information on franchise available...Item 203

ROOF VENTILATORS. Page 155. Streamlined, propeller driven, roof mounted ventilators with the motor out of the air stream, are available in 15 sizes, 254 to 10,280 cfm. Ventilators handle moist air without concern for motor damage or corrosion. Application information available. ----------Item 204

STEAM GENERATOR. Page 31. A new small boiler designed as a single package in capacities up to 80 hp for heating or processing steam or hot water features 4-pass firetube construction, silent operation, five square feet of heating surface per boiler horsepower. Burns oil, gas, or combination. Automatic safe operation and easy maintenance. Catalog available. ----------Item 205

POWDER ACTUATED FASTENING. Page 154. For anchoring work into steel or concrete, requiring ¼ inch fasteners, the standard powder-actuated stud fastener is a quick, convenient tool. Where heavy-duty ⅜ inch fasteners are needed, the greater driving power of a new, larger fastening tool sets studs instantly into 1 inch mild steel or into the hardest concrete. Literature available.....Item 206

DAMPER CONTROL. Page 155. This damper control provides four control features essential to efficient operation of induced draft systems. System includes starting draft collector, automatic draft modulation, automatic sequence operation and low draft cut-off. Information available. ----------Item 207

AUTOMATIC HEATING SYSTEM CONTROL. Page 47. Now you can cash in on big new profits in the hot water heating field with this company's new indoor-outdoor control for forced hot-water heating systems. That's because this control offers heating comfort never before possible in forced hot water heating systems, consistently uniform and completely automatic. Bulletin available.....Item 208

DIRECT FIRED HEATERS. Page 155. Direct fired heaters give heat when and where you need it at the flick of a switch which saves on low initial cost and have fully automatic controls. Available for gas, oil, coal or dual gas and oil. Information available.....Item 209

AIR FILTER GAGE. Page 149. This company's air filter gage provides a visual check of filter efficiency on any system. Determines exact filter efficiency the only practical and economical way: via pressure drop. The low first cost is repaid over and over through savings in replacement and service time, plus maintained optimum filter efficiency. Catalog available...Item 210

GAS ANALYZER. Page 138. The first of its type developed for field work, this company's gas analyzer answers the need for an analyzer husky enough for use in the boiler room and for installation and service work in commercial and home heating plants, yet simple, fast, and accurate. Publication available.....Item 211

AIR HANDLING EQUIPMENT. Page 34. Air handling equipment in a modern hospital must be dependable and quiet in operation. At Oakwood Hospital $5 million medical center in Dearborn, Michigan, this company's air handling equipment was specified. The equipment is built to run continuously at rated capacities with no breakdowns and minimum maintenance expense. Information available....Item 212

GRILLES. Page 149. This company's grille, with detachable volume control, features increased directional control, elimination of possibility of tampering or accidental changes and accurate metering of air flow. Matching return air grilles available. Information available.....Item 213

TEMPERATURE MEASUREMENT. Page 10. This company's temperature measuring instrument is invaluable for balancing hot water heating systems, reading floor, wall or ceiling temperatures, checking refrigerated coils, insulation and all other low temperature surfaces. Bulletin available. ----------Item 214

HEAT EXCHANGERS. Page 148. These heat exchangers are three ways better. They are designed for maximum operating efficiency and rapid heat transfer, built for optimum performance and life, and engineered to suit your requirements. Catalog available.....Item 215

COMPRESSORS. Page 7. These compressors operate at speeds much slower than other compressors of the same capacities. They deliver full capacity refrigeration and air conditioning with less costly motion, less wear on working parts, less maintenance required, and lower operating costs. Information available.....Item 216

WATER CHILLERS. Page 53. These water chillers come factory assembled with circuits completely piped, wired, and tested, and can be installed in a half hour. Just make a few simple electrical and plumbing connections and the chiller is installed. Literature available.....Item 217

FIN AND PIPE COILS. Page 147. Fin and pipe coils or stainless steel solved an acid vapor heating and cooling problem in industry. These coils are ideally suited for handling all types of corrosive air mixtures, gas or liquid for heating or cooling needs. Send details or blueprints for engineering advice.....Item 218

FANS. Page 150. When planning your ventilating systems get all the facts. Each new job presents different cooling and ventilating problems that this company can successfully solve for you. Write for complete data on the hundreds of possibilities offered in the wide range of styles, sizes and capacities. Data sheets available...Item 219

Circle numbers corresponding to the advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers.

PLEASE SEND US MORE INFORMATION

Circle below item numbers on which you wish further information.

201	202	203	204	205	206	207	208	209	210	211	212	213	214
215	216	217	218	219	220	221	222	223	224	225	226	227	228
229	230	231	232	233	234	235	236	237	238	239	240	241	242
243	244	245	246	247	248	249	250	251	252	253	254	255	256
257	258	259	260	261	262	263	264	265	266	267	268	269	270
271	272	273	274	275	276	277	278	279	280	281	282	283	284
285													

PLEASE PRINT Dec. AD-54

This service available only to U. S. and Canadian readers

Name..... **Title**.....

Firm .....

Nature of Firm's Business.....

Street .....

City..... **Zone**..... **State**.....

This card is void after May 1, 1955

Ad-Digest SERVICE

AIR FILTER. Page 117. This company's general office building served as a proving ground for it's new automatic renewable media air filter. Cleaning efficiency of the bonded glass fiber blanket was instrument-checked regularly. Media usage was measured meticulously. Every mechanical feature was observed and evaluated under service conditions. The filter's efficiency and cost cutting operation established a record which is now being duplicated in many installations. Bulletin available. ----------Item 220

AIR CONDITIONING. Page 153. Fairchild Aircraft uses this company's air conditioning. The company recently completed the engineering and installation of a year-round comfort system for the aircraft company's new plant. Information available. ----------Item 221

COOLING TOWERS. Page 119. A 20-year guarantee on the wetted-deck surface of these residential cooling towers is offered by the manufacturer. These towers recirculate precious water, meet requirements of municipalities which prohibit wasting cooling water to sewers and are low in cost. Bulletin available.----------Item 222

PUMPS. Page 25. These pumps, designed by men who really know pumps, feature quiet operation, low inlet connection and are easily accessible. They are available in single units or duplex. These pumps are adaptable to every installationfi Bulletin available. ----------Item 223

PACKAGED AIR CONDITIONERS. Page 131. These packaged air conditioners are so quiet in operation they can be put in or near the conditioned area, saving duct-work and wiring. You can easily split a unit when need arises. Air cooled models don't need water savers or plumbing. Information available.----------Item 224

BOILER TUBES. Page 11. What to look for in a boiler tube. Look for uniform wall thickness, uniform ductility, low installation cost, and tight joints. These boiler tubes have these features and are designed to meet the specifications of time. Information available.----------Item 225

FILTERS. Page 48. Ad features random thoughts from a filter engineer including a description of the company's special filter for recirculated air and outline of the company's policy on shipping mistakes and a story on how one of its installations was features in a movie. Information available.----------Item 226

REGULATORS. Page 158. Science, research, and engineeirng experience spell this company's know how as a world leader in the manufacture of its many products including valves, controls, and regulators. Information available. Item 227

DIFFUSERS. Page 20. These diffusers are designed and engineered for easy installation and to handle high loads and high ventilating requirements, with a uniform low rate of room air motion. They meet the most exacting demands of industrial processing and scientific research. Information available.----------Item 228

WATER TANKS. Page 153. Quality is the first consideration in the construction of these tanks. As a pioneer in the field of fabricating A.S.M.E. code vessels, this company offers the engineering and production know how to build tanks that will meet every requirement. Information available.----------Item 229

UNIT HEATER. Page 156. This company makes the only oil-fired unit heater with outputs from 112,000 to 280,000 BTU per hour. Information available.----------Item 230

VIBRATION CONTROL. Page 136. This company utilizes all three vibration control media, rubber, steel, and cork. During its half century of experience this company has come up against and solved almost every imaginable type of vibration problem. Send for isolation Selector Chart and additional data on increasing production and reducing costs. Bulletin available.----------Item 231

SOLDER-JOINT FITTINGS. Page 51. There are no threads on this copper tube and these solder-joint fittings to save time and cut costs. With these fittings you can install a completely pressure tight drainage system, using standard soldering techniques. The tube comes in 20 foot lengths and requires fewer joints. Information available.----------Item 232

PIPE. Page 28. This company offers pipe line to save you money. Seven points of uniform goodness in this pipe include uniform ductility, uniform lengths, uniform threading, uniform weldability, uniform wall thickness and sizes, uniform strength and toughness, and uniform roundness and straightness. Information available. ----------Item 233

BOILERS. Page 46. The new YMCA in Tulsa Oklahoma gets more heat for the money with this company's boilers featuring jet-action circulation. In these boilers, steam and hot water are propelled at high speed across the heating tubes by this company's exclusive jet like circulating connections. They come in all sizes, using all fuels, for any type of building. Information available.----------Item 234

PACKAGED AIR CONDITIONERS. Page 137. This company has the answer to air conditioning problems in any office, store, or factory. Features of this packaged air conditioning include low installation and operating costs, maximum design freedom, streamlined styling, and weather control. Architectural data available. ----------Item 235

BOILER. Page 50. This company's VP boiler is now available in up to 40,000 pounds per hour capacity. No boiler has ever caught on more quickly or received more widespread enthusiasite acceptance than this boiler. Why not investigate the extra values you can have with this company's boiler? Catalog available. Item 236

TEMPERATURE CONTROL. Page 127. This company's pneumatic system of temperature and humidity control was selected for the Anti-Aircraft and Guided Missiles Branch of the U. S. Artillery School Building at Fort Bliss. Proper temperature for maximum comfort and efficiency will be maintained in all classrooms, auditoriums, and administrative facilities by this company's control system. Information available.----------Item 237

TEMPERATURE CONTROL. Back Cover. Considered the most important feature of the new Gordon C. Swift Junior High School is this company's system of automatic temperature control which regulates the unique heating and ventilating system. A forced warm air heating system serves the classroom wing. Individual room thermostats assure a constant supply of fresh perfectly tempered air to each room. Information available.----Item 238

DUST CONTROL. Page 38. Air pollution is as close as your parking lot. Dust covered cars offer visual proof that a dust control problem is just half licked. The solution is a complete dust control as provided by this company's equipment including dynamic precipitators, hydrostatic precipitators, dry centrifugals, and fabric arresters. Information available. Item 239

ROOF DRAINING. Page 21. This company offers a complete, informative guide for specification and installation of roof drains. The booket includes roof drain and outlet sizing data, installation drawings of drains in standard types of roof construction, and a complete illustrated index of large easy-to-read product drawings and descriptions. Catalog available.----Item 240

INDUSTRIAL FANS. Inside Back Cover. These industrial fans are particularly well suited for diversified air material handling applications. You will profit from the high efficiency, in the field adaptability, and numerous other features of this exceptional fan equipment. Bulletin available. ----------Item 241

DUCT FANS. Page 156. This company's tube axial duct fans offer the answer to the problem of positive removal of fumes, vapors, odors, dust, and heat with a minimum of installation and maintenance cost. Catalog available. ----------Item 242

Postage Will be paid by Addressee

No Postage Stamp Necessary If Mailed in the U. S.

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 58, SEC. 34.9, P. L. & R., NEW YORK, N. Y.

HEATING AND VENTILATING
148 LAFAYETTE STREET
NEW YORK 13, N. Y.

AD-DIGEST SERVICE

FAN COOLERS. Page 61. Stop using water. Eliminate all water problems with this company's fan cooler. Any size compressor, regardless of tonnage, can be air-cooled with this unit. Stands, hoods, and wing deflectors are available for simplified outside mounting. Bulletin available. ----------Item 243

FILTERS. Page 57. When it costs thousands of dollars to install an air conditioning system, why take a chance on the effectiveness of the job by installing ordinary filters because they cost a little less? For a few dollars more you can buy the right type of filter from this company to fit the job and be sure of cleaner air, longer service life, and lower maintenance costs. Catalog available.----------Item 244

FANS. Page 49. This company offers the best gift for your plant in its dependable fans. These fans feature the "Q" factor, a built-in quality which provides trouble-free satisfaction and long life. Bulletins for all fans are available. ---------Item 245

FANS. Page 56. An interesting and necessary feature of the new zinc and cadmium plating line at Appleton Electric Company, is the compactness of this company's fan exhaust system. Centrifugal units would have necessitated an expensive modification in the building structure, but the compact in-line design of this company's fans permitted installation right in the ducts on the floor above the plating line. Bulletin available. ----------Item 246

BASEBOARD RADIATION. Page 9. This company's integrated radiation system for daytime classroom comfort also maintains satisfactory night-time temperatures without another investment. Extensive field tests have proved that when the company's radiation is combined with its syncretizers, the combined gravity heating capacity is ample to maintain overnight temperatures of 55 degrees in zero weather. Engineering report available. ----------Item 247

BOILER. Page 120. This boiler is more economical because it is completely water-jacketed. Particularly important is the water-cooled rear furnace wall which reduces flue gas temperatures, saves fuel, and eliminates the original expense of dry-wall refractory lining. Information available. ----------Item 248

POWER VENTILATORS. Page 148. For maximum exhaust install this company's power ventilators. Their absolutely free-opening channels air vertically upward at high velocity. Bulletin available.---Item 249

DIAL THERMOMETERS. Page 157. This company presents an outstanding improvement in dial thermometers with its external calibration 3½ inch thermometer. Features are no sector, no pinion, no linkage, constant accuracy, and easy readability. Bulletin available. --------Item 250

AIR DISTRIBUTION. Page 125. Students study in comfort at the new library at Oklahoma A&M. Complete with summer-winter air conditioning, the new structure is serviced by this company's air distribution equipment including ceiling diffusers, and supply, return, and door grilles. Information available. ----------Item 251

MOTOR CONTROLS. Page 36. When you buy a manually-operated auto transformer starter, don't overlook the big advantages of this company's starters. Starting voltage taps are clearly labeled and easily adjusted to suit starting conditions. Time delay under voltage release is optional. On your next job requiring a manual, reduced voltage starter specify this company's starter. Bulletin available..Item 252

RADIATORS. Page 129. For hundreds of steam and hot water heating applications these versatile cabinet units provide economical comfort. Quiet blower fans assure positive yet gentle circulation of heated air. They are ideal for new construction or modernization. Bulletin available...Item 253

AUTOMATIC CONTROL. Pages 26, 27. Proved in 50,000 installations this control provides safe programming for any burner application. It is easy to install and service, and gives long-time dependability with minimum maintenance. Components are of superior industrial quality, they withstand moisture, vibration, high temperature, and give continuous peak performance. Every unit is cycle tested equivalent to one-month's operation before leaving the factory. Information available. ----------Item 254

COPPER TUBE. Page 135. Six and 8 in. water mains of this company's copper tube are installed in Montreal's multi-million dollar Ste. Justine's Hospital. The installation saves on operating costs. The smooth rust-free interior surface means lower pumping costs. Information available. ----------Item 255

PUMPS. Page 147. This company's type AC pump mounts easily in limited space and in any position. Adjustable four-way discharge facilitates location of pump and of recirculation lines. Bulletin available. ----------Item 256

PACKAGED BOILERS. Page 59. This boiler is now available with your choice of burners from three leading manufacturers. Three complete boiler burner packages, each in a full range of sizes, handling oil, gas, or combination oil and gas assures maximum efficiency and dependability on the job. Bulletins available.-------Item 257

DRAIN PIPE. Page 152. This acid-proof drain pipe resists corrosion permanently. Think what this means in savings over the installation and reinstallation of less permanent piping. Information available. ----------Item 258

VALVES. Page 44. The 30th service anniversary for a set of boiler feed valves installed in 1925 is coming soon with a record of no repairs to date. Even more significant than the 30 years service, is the quality of performance of these 250-pound iron body gate and check valves. Never since 1925 have they needed repairs or maintenance, nor were they given more than customary routine care. Information available. ----------Item 259

STRAINERS. Page 156. The uniform snug fit of screen in these strainers is guaranteed by gasketed cap and tapered seats. When furnished with semi-steel body and perforated brass-sheet screen these strainers are of 250 pound design. Bulletin available. ----------Item 260

FANS. Page 1. These fans exhaust fumes at top efficiency by avoiding a directional change in the air stream. The fan motor stays clean, cool and accessible. Fumes are by-passed around the motor chamber which is completely isolated from the exhaust stream. The fan is easily installed just like a section of ductwork. Bulletins available. ----------Item 261

BASEBOARD RADIATION. Page 23. These baseboard convectors represent the latest in modern space-saving heating, especially designed to meet architects, engineer and contractor requirements. Made to harmonize with all types of construction this radiation is packaged in lightweight sections, and installs quickly and easily. Catalog available. ----------Item 262

WATER HEATERS. Page 123. In January, 1937, 31 of this company's copper-lined water heaters were installed at Boston's Old Harbor Housing Project. For seventeen years, thousands of residents have enjoyed the benefits of an adequate and unfailing source of rust-free hot water. Catalog available ----------Item 263

UNIT HEATERS. Page 52. Here's beauty to match the efficiency and economy that this company's heaters are famous for. Features include brand new styling, quiet fan wheels turn with almost imperceptible sound. Recessed baseboard, key-operated two-speed switch. Eight models, for floor, wall ceiling, or recessed applications. Information available. ----------Item 264

Use this Digest to locate and refer to advertisements appearing in this issue of HEATING AND VENTILATING, then fill out and mail the prepaid postcard to request further information

Circle numbers corresponding to the advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers.

PLEASE SEND US MORE INFORMATION

Circle below item numbers on which you wish further information.

201	202	203	204	205	206	207	208	209	210	211	212	213	214
215	216	217	218	219	220	221	222	223	224	225	226	227	228
229	230	231	232	233	234	235	236	237	238	239	240	241	242
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257	258	259	260	261	262	263	264	265	266	267	268	269	270
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285													

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Ad-Digest SERVICE

CONDENSATE PUMPS. Page 145. Condensate pumps in capacities from 500 to 10,000 sq. ft. E.D.R., available in both single and duplex units. Technical bulletin available. ----------Item 266

ROOF FANS. Page 147. Whatever roof ventilation problem you face, you can rely on Allen engineered, high efficiency roof fans for the solution. These motor driven fans are ruggedly designed to do a steady, heavy duty job, removing air laden with heat, fumes, vapor, and dust. Available in a wide range of capacities. Catalog available. ----------Item 268

TEMPERATURE CONTROL. Page 115. This company offers one dependable source for all hospital requirements of automatic temperature and humidity control. This company's air conditioning control helps hasten recovery of patients and is adaptable to all types of hospital heating and air conditioning systems. Information available ----------Item 267

ELECTRIC MOTOR. Page 19. This motor has helped to build more than one product reputation by its outstanding performance. Available for many applications in the air conditioning, heating and refrigeration field. The company has specialists ready to help solve the most complex motor problem. Bulletin available. -----Item 268

DOOR HEATERS. Page 54. When winter comes keep production moving with these door heaters. Cold blasts from open doors are stopped in their tracks by these door heaters, which go into action automatically when the door is open. Workers are healthier, happier, keep right on working when doors are open. Bulletin available. ----------Item 269

COPPER TUBE. Page 55. The best distributors in America sell this company's copper tube and one of the best ways to judge a product is by the calibre of the distributors who sell it. Next time you need copper tube, specify this company's tube, a precision product of one of America's largest, completely integrated mills, specializing in the processing of copper tube from basic metal to finished tubing. Catalog available. ----------Item 270

STEAM TRAP. Inside Front Cover. Only this steam trap gives you all of these features for low pressure heating service. Features include quick heating, easy installation, integral strainer, and stainless mechanism. The traps are self-scrubbing, non-air binding and immune to corrosion. Catalog available.----------Item 271

STEAM GENERATOR. Page 43. In your selection of a boiler, it's important to remember that experience does count. And what better assurance of top boiler quality than this company's record, 106 years of building fine boilers, boilers which have given economical satisfactory service throughout the industry. Many units purchased 40 to 50 years ago are still faithfully on the job. Information available. ----------Item 272

PUMPS. Page 133. However specialized your need for a circulating pump, you are sure to find the model and size that exactly fits your requirements in this company's recently expanded centrifugal pump line. You can get high efficiency pumps in either close-coupled or flexible-coupled models with capacities from 5 to 400 G.P.M. and for heads from 10 to 190 feet. Bulletins available.----------Item 273

UNIT HEATERS. Page 149. Whatever your comfort heating requirements this company has an electric unit heater that fits the picture exactly. Portable, mounted, built-in, or blower types from ¼ to 40 K.W. Information available.-------Item 274

AIR DIFFUSERS. Page 35. Your customers get the superior comfort that comes from accurate control of both volume and pattern of air flow with these diffusers. Handsome, unobstrusive and highly efficient, these adjustable diffusers mix incoming and room air thoroughly well above the heads of room occupants. Data book available.----------Item 275

REFRIGERATION UNITS. Page 42. This air conditioning equipment has been the choice of leaders in business and industry for over 50 years. This company's equipment cooled 35,000 airline passengers a day at New York City's new eastside airline terminal. A 315-ton centrifugal refrigeration system, along with air handling equipment and pumps carries the entire cooling load for the terminal's 3,300,000 cubic feet of space. Information available.---Item 276

AIR HANDLING EQUIPMENT. Page 40. In modern supermarket operation every square foot of space must count. That's why this company's ceiling type air units were selected for the newest Detroit outlet of National Food Stores. Suspended from the ceiling, these compact air units release badly needed floor space for storage or other uses. Information available. ----------Item 277

COPPER WATER TUBE. Page 113. York Corporation uses copper water tube manufactured by this company in air conditioning fourteen floors of the Netherland Plaza Hotel in Cincinnati. Installation of the risers was simplified because no threaded connections were necessary, there were fewer fittings, and what few fittings were necessary, were readily soldered. Information available.----------Item 278

MOTOR. Page 144. In an internally geared motor the pinion on the motor shaft is the vital link between motor and gearing. This pinion has a long solid shank that anchors into the motor's hollow shaft, whereas the ordinary shell type has a small section area, short keyed. Booklet available. ----------Item 279

AIR DISTRIBUTION. Page 16, 17. A pioneer in the development of high pressure air conditioning systems this company manufactures a complete line of equipment to meet the varied requirements of a wide range of buildings and types of construction. Units include single and double duct wall and ceiling types for individual unit or zone control, and are capable of handling branch duct velocities up to 4,000 feet per minute. Bulletin available. ----------Item 280

MOISTURE REMOVAL. Page 134. This company's fresh air method removes the excess moisture from outdoor air by contact with an absorbent liquid in a spray chamber. This method is noted for solving the really difficult problems of air conditioning. Information available.---Item 281

STEAM GENERATORS. Page 41. These steam generators are the ideal choice for a new steam plant. They are the simplest answer to expanding your present plant and the easiest solution to replacing obsolete boilers. 18 sizes from 20 to 600 b.h.p. for pressures to 250 p.s.i. or for hot water. Catalog available.----------Item 282

HEAT EXCHANGERS. Page 39. In the Peninsula Hospital, California, this company's steam-to-water heat exchangers are used to supply hot water for the space heating system. The reverse return piping plan is divided into four individually controlled zones equipped with convector heating units. This method affords all the benefits of forced hot water heating without the expense of extra boilers. Catalog available.----------Item 283

PERIMETER HEATING. Page 2. At Grandview Airforce Base, perimeter heating by this company provide more space, more privacy, and more comfort. For heating comfort nearly 2¼ miles of convector circle the exposed walls creating a blanket of clean, gentle, even warmth. Information available.----------Item 284

BOILERS. Page 37. This boiler provides equal flow of combustion gases to all return tubes so that all heating services are equally effective. Adequate water circulation is provided by proper arrangement of furnace and return tubes. Bulletins available.----------Item 285

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HEATING AND VENTILATING

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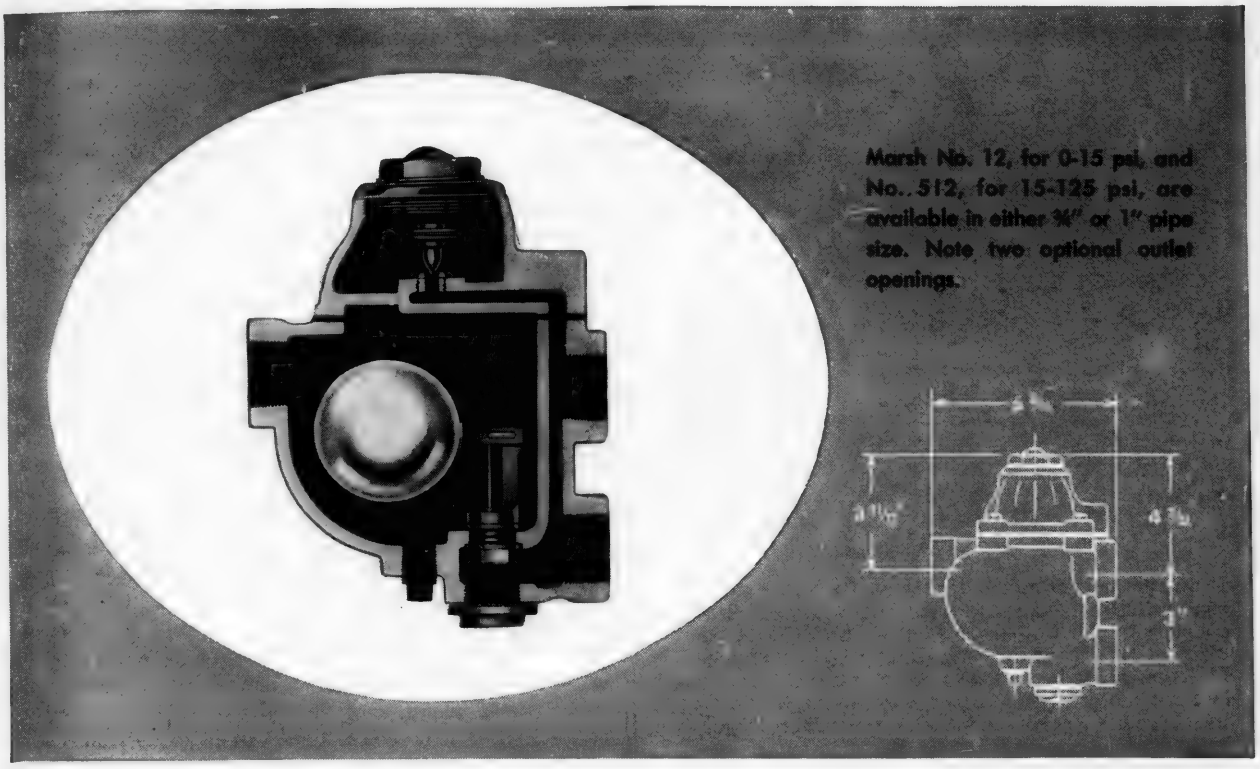
NEW YORK 13, N. Y.

AD-DIGEST SERVICE

MARSH No. 12

Float and Thermostatic Trap



Marsh No. 12, for 0-15 psi, and No. 512, for 15-125 psi, are available in either ¾" or 1" pipe size. Note two optional outlet openings.

. . . The most dependable trap you can use

There are many jobs that only a float *and* thermostatic trap can handle properly . . . and in the Marsh No. 12 you have the most respected F & T trap ever developed.

Here is a trap that counts its users in thousands. Repeat orders are the rule because men who know have discovered that no other trap can quite duplicate its absolutely dependable, trouble-free performance in removing all air and condensate from steam mains, branches, risers, unit heaters, coils, and similar applications.

Two precision-built assemblies accomplish this. All condensation is discharged by the float-operated valve located at the low point in the trap body. All air is vented through the by-pass by the action of the thermostatic diaphragm, but this is one of those Marsh diaphragms that closes the valve immediately in the presence of steam. In fact the accuracy of response is the attribute that distinguishes the Marsh thermostatic element. It gets the air out and keeps the steam *in!* Another big feature is the straight through design which eliminates troublesome excess piping.

No. 12 is your F & T trap for those low pressure applications—up to 15 psi W.S.P. but its identical-in-operation companion, No. 512, covers the working pressure range of 15 to 125 psi. There is a Marsh trap for every low or medium pressure application.

Write for catalog 76-H covering Marsh heating specialties

MARSH HEATING EQUIPMENT CO., *Sales Affiliate of Jas. P. Marsh Corporation*

Dept. U, Skokie, Illinois

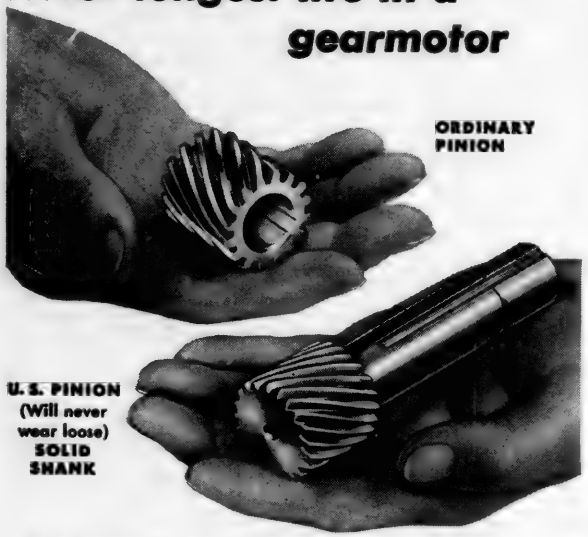
Manufacturers of gauges, thermostatic regulating valves, Solenoid valves, heating specialties

MARSH *Heating Specialties*

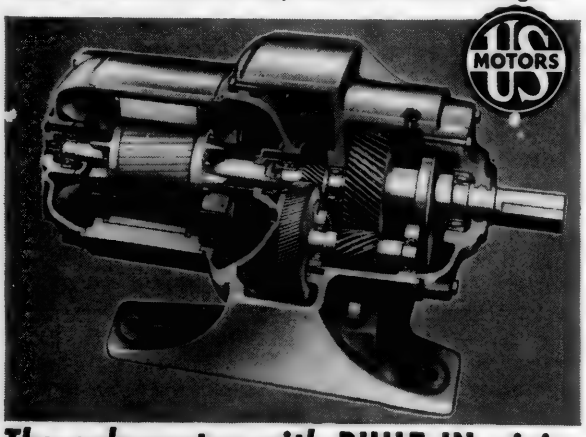
SINCE 1865

IN YOUR OPINION, WHICH PINION?

...for longest life in a gearmotor



In an internally geared motor the pinion on the motor shaft is the vital link between motor and gearing. Now compare the U. S. Syncrogear motor pinion with the common type. Note the extra large section area of the U. S. design. It has a long solid shank that anchors into the motor's hollow shaft, whereas the ordinary shell type has a small section area, short keyed. Obviously the U. S. design is most substantial, longer lasting, more resistant to deflection and can carry high speed loads far more safely than the common designs.



The only motor with BUILT-IN *pinion*

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ATOMIC POWER

(*Continued from page* 138)

explored foreign progress in the field, and examined the prospects of world-wide cooperation for development of peaceful uses of atomic energy. In addition to noted American speakers, leading foreign scientists and the heads of atomic energy programs of several foreign countries addressed the conference. A special session of the conference discussed the commercial utilization of solar energy (covered elsewhere in this issue).

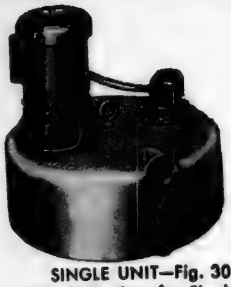
• **COST DISCUSSED.**—The current outlook for atomic power costs was covered in an early session of the conference, with speakers on such topics as the realistic evaluation of nuclear power reactors, competitive nuclear power, cost factors in nuclear power plants, and an engineering appraisal of atomic power costs. In a talk on the realistic evaluation of nuclear power reactors, W. Kenneth Davis, assistant director of reactor development, U. S. Atomic Energy Commission, pointed out the need for practical thinking in the estimation of atomic power plant costs as competitive with conventional types. He stated that in considering the time scale for the development of economic nuclear power, one must be careful not to substitute hopes for facts, with regard to the present state of development of nuclear power, and must not ignore the capabilities of the conventionally fueled steam power plants. He stated his belief that it is essential to use a realistic basis for comparison of nuclear plants with conventional plants, and the difficulties of this with today's limited experience. However, after defining "economically competitive nuclear power," and outlining a realistic appraisal of the status of development today, Mr. Davis expressed optimism that mature engineering judgment would bring about the ultimate achievement of this end.

• **NEW ATOM LAW.**—The significance of the 1954 amendments to the Atomic Energy Act came under scrutiny in a morning session of the conference, with speakers reviewing the various aspects and effects on the nuclear power industry here and abroad. John W. Landis, of the Babcock and Wilcox Co., stated that although the new law has not removed all the barriers to free operation of private initiative in the field, it has given some substance and reality to nuclear power as a business for commercial gain. William Mitchell, general counsel for the U. S. Atomic Energy Commission, explained the operation of the new law, covering in his talk, some aspects of research and development licenses. In a discussion of the revisions of the patent provisions, Casper W. Ooms, a member of the patent advisory panel of the U. S. Atomic Energy Commission, stated that "surveying the act as a whole," he thought that it was a definite improvement on the 1946 provisions, in that it increased the area in which normal patent practices might apply.

• **RAW MATERIAL SUPPLY.**—The raw materials supply picture was outlined in a session of the conference devoted to that topic. Prominent speakers dealt with the role of private enterprise in the raw materials supply, the foreign and domestic supply pictures, and a discussion of

(*Continued on page* 146)

LOW PRESSURE SYSTEM *Condensate Pumps*



SINGLE UNIT—Fig. 302A
10 Gal. Receiver for Single Units
Diameter 21"
Hgt. of Return above floor 6⅞"

Capacities 500 to 10,000 sq. ft. E.D.R.

weil TVC PUMP

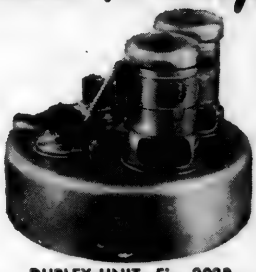
LOW RETURN CONNECTION

LOW SPEED, LONG LIFE

CAST IRON RECEIVER

LOW WATER LINE

ELECTRODE OR FLOAT SWITCH CONTROL



DUPLEX UNIT—Fig. 303B
15 Gal. Receiver for Single or Duplex Units
Diameter 25½"
Hgt. of Return above floor 7⅜"

TVC SELECTION TABLE

Unit Number	Max. Sq. Ft. E.D.R.	Discharge Pressure At Pump	G.P.M. From Radiation	Cap. of Pump	H.P. of Motor	Return Inlet	Pump Discharge	Dia. of Receiver	Height of Unit
TVC 13	500	20 lbs.	.25	1.0 GPM	1/4	2"	1"	21"	21"
TVC 19	750	20 lbs.	.38	1.5 GPM	1/4	2"	1"	21"	21"
TVC 23	1000	20 lbs.	.5	1.5 GPM	1/4	2"	1"	21"	21"
TVC 29	2000	20 lbs.	1.0	3.0 GPM	1/4	2"	1"	21"	21"
TVC 35	4000	20 lbs.	2.0	6.0 GPM	1/4	2"	1"	21"	21"
TVC 41	6000	20 lbs.	3.0	9.0 GPM	1/2	2"	1"	21"	23½"
TVC 47	8000	20 lbs.	4.0	12.0 GPM	1/2	2"	1"	25½"	23½"
TVC 52	10000	20 lbs.	5.0	15.0 GPM	3/4	2"	1"	25½"	27½"

See Bulletin TVC-300-C for Full Specifications

Intermediate Sizes Based Upon Discharge Pressure Required Are Available.

weil PUMP CO. 1516 NORTH FREMONT ST., CHICAGO 22

By all means...check with Paracoil

before you place that order for INDUSTRIAL HEATING, COOLING, VENTILATING AND PROCESS HEAT EXCHANGER EQUIPMENT

"We have been doing just that for over a quarter of a century—and we know we have saved ourselves thousands by taking their recommendations on any problem involving heat exchangers. They are represented in all principal trading areas, too, so you also can benefit from their experience, just as we have through the years."

You are so correct, Mr. PARACOIL CUSTOMER. Whenever well designed and well built heat exchangers — adequately engineered to give customer satisfaction year after year — are being investigated, the smart buyer has always preferred PARACOIL equipment! They always have had that *extra something* that made them more than just an assembly of tubes inside of a shell!

Paracoil Heat Exchangers for the heating, piping and air conditioning contractor include:

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HEAT EXCHANGERS

3 WAYS BETTER

1. Designed for maximum operating efficiency and rapid heat transfer.
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Tank Heating Units

Condensate Coolers
Converters
Fuel Oil Heaters
Oil Coolers
Radiation Heaters
Water Heaters

Chillers

ATOMIC POWER

(*Continued from page* 144)

Canadian uranium deposits. Rafford L. Faulkner, assistant director for foreign procurement, U. S. Atomic Energy Commission, in reviewing the foreign supply picture, traced the development of the U. S.'s uranium procurement system from our initial investments in the Belgian Congo to our present diversified activities in uranium procurement. He was unable to include quantitative figures relating to present or projected uranium production due to security restrictions on information of that type, but he did state that a review of all known sources of radioactive fuels clearly indicates that adequate amounts will be available to supply the needs of a nuclear power industry. R. J. Henry of the Canadian firm of Eldorado Mining and Refining Ltd., discussed Canada's uranium deposits and the role Canada hopes to play in the field of raw materials for the atomic power industry. Mr. Henry gave brief descriptions of the locations and approximate value of Canada's uranium ore, and outlined the policies in use between the Canadian government and the private companies who mine the ore.

• **MARKET POTENTIALS.**—Market potentials in atomic energy and related industries came under discussion on the second day of the conference, when talks were presented on the nature of the product market in the nuclear power field, instrumentation in an expanding atomic age, the probable impact of atomic energy on the petroleum industry, and investment potentials in atomic energy. In a talk on the nature of the product market in the nuclear power field, Frederick H. Warren of General Dynamics Corp., states that there are certain general observations at the outset. "First, as has been noted many times, a large fraction of the normal power plant investment is scarcely changed by conversion from fossil fuels to nuclear energy. Second, the one really unique element of a nuclear powered plant is the reactor fuel core itself. Third, all other features are conversions or adaptations of well-known industrial equipment items." Mr. Warren went on to say that industry should coordinate to meet the special demands of nuclear specifications. Dr. Robert E. Wilson, speaking on the probable effect of atomic energy on the petroleum industry, predicted that no important phase of the oil industry would be adversely affected by atomic energy in the foreseeable future, and that, if anything, the oil industry would benefit from it. The Standard Oil chief executive went on to pay tribute to government, university, and industrial laboratories for the research already done on atomic fuels, but added that he thought the present development of atomic power was no serious threat to the oil industry.

• **PACKAGED REACTORS.**—Col. James B. Lampert, chief of the Army Reactors Branch of the AEC, announced to a session of the conference that the Department of Defense and the Atomic Energy Commission are jointly contracting for the design and construction of a full-scale prototype packaged nuclear power plant to be built at Fort Belvoir, Va. Col. Lampert stated the objectives of the program as: To demonstrate features and characteristics of a particular nuclear power plant that will permit

(*Continued on page* 148)

Industry Had Acid Vapor Heating and Cooling Problems

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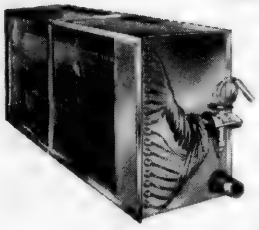
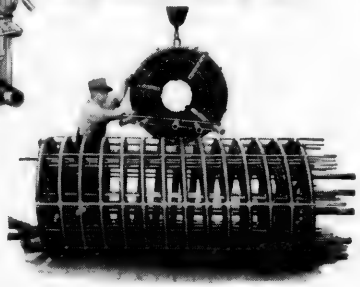


Rempe Fin Type Coils are ideally suited for handling all types of corrosive air mixtures, gas or liquid, heating or cooling needs.



We have complete facilities and tested technique in the fabrication, welding and finishing of pipe coils made from all types of stainless steel.

Send details or blueprints for engineering advice and quotations on your requirements, for all types, all materials of pipe and fin coils.

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The Answer to Every Rooftop Ventilation Problem . . .

Easily inspected and serviced. Just remove two bolts and tilt hood.

Allen High-Efficiency ROOF FAN

Whatever roof ventilation installation problem you face, you can rely on Allen-engineered, High-Efficiency Roof Fans for the solution. These motor-driven fans are ruggedly designed to do a steady, heavy-duty job, removing air laden with heat, fumes, vapor, dust. Installation is rapid, easy. To install, merely cut opening in roof, flash housing to roofing material, and connect electrically. Designed for flat roof or level curb installations. Available in wide range of capacities (750 to 45,000 cfm), many sizes, and in Standard, Direct Drive, and Remote Drive types. Write for catalog on complete line of roof ventilators.

Representatives in principal cities are listed in our catalog in Sweet's Architectural File, Section 20b.

ALLEN ENGINEERED VENTILATION

ALLEN COOLER & VENTILATOR INC.

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Roof Ventilators for Every Commercial and Industrial Need

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AIR CONDITIONING ENGINEER

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CENTRIFUGAL PUMP SPECIALIST

Both Experts in their fields . . . ready to aid you in YOURS!

Engineers specializing in Air Conditioning strive constantly to provide American industry with reliable climate controlled conditions that even out temperature extremes . . . providing greater efficiency through more comfortable working conditions.

Behind these capable experts, as well as others in all forms of heating and ventilating, you will find Weinman Centrifugal Pump Specialists, who wholeheartedly cooperate at all times to help solve pumping problems . . . and to supply pumps tailored to their specific needs . . . pumps that will deliver reliable, dependable continuous service.

If you're a heating and ventilating engineer, contractor or equipment manufacturer, you can eliminate your pump problems . . . permanently . . . by simply calling in an experienced Weinman Centrifugal Pump Specialist!

The WEINMAN Type AC Pump . . . mounts easily in limited space . . . in any position. Adjustable 4-way discharge facilitates location of pump and of recirculation lines. Write for Bulletin 725.

Representatives in principal cities

Built by Centrifugal Specialists

The WEINMAN Pump Mfg. Co.

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INSTALL BURT F.E.F.
POWER VENTILATORS

For fast, localized removal of high heat, smoke, fumes and dust, the Burt F.E.F. (Free Exhaust Fan) Ventilator does an outstanding job. Its absolute free opening channels air vertically upward at high velocity. Its specially designed Burt Axial Flow Fan provides a high volume of air delivery with efficiency and economy. Seven sizes and seventeen motors provide wide flexibility. See Sweet's for Burt F.E.F. data or write for Bulletin SPV-18.

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The Burt Manufacturing Company

49 E. South Street, Akron 11, Ohio

Member Power Fan Manufacturers Association

ATOMIC POWER

(*Continued from page* 146)

use of a plant of this type in an Arctic environment, to determine the exact economic and operating characteristics of the plant, to determine the reliability of continuous operation, and to provide training facility for military engineers, operating crews, and maintenance personnel. "Persons hopeful for small nuclear plants which would be economic in isolated rural areas, mining camps, or undeveloped countries" stated Col. Lampert, "have expressed interest in following development of the small military plant."

• **INTERNATIONAL PROGRESS.**—In the sessions on international developments in atomic energy, speakers from Denmark, Brazil, Germany, France, Canada, Italy, and Belgium reported to the conference on progress in their respective countries. Niels Bohr, the eminent Danish physicist, and director of the Institute for Theoretical Physics in Copenhagen opened the first session devoted to international developments. The second session on this vital topic included talks on the problems of developing atomic energy in Brazil, the potentials of atomic energy in West Germany, and a talk by Francis Perrin, Le Haut Commissaire, Commissariat a l'Energie Atomique, France, on atomic energy in France. Mr. Perrin outlined the development of the atomic program in France, relating the problems and successes, and telling briefly where this program stands now and what is planned for the future. Pierre Ryckmans, president of the Centre d'Etudes pour les Applications de l'Energie Nucleaire, Brussels, delivered the last talk of the conference, with a review of what Belgium is doing now, and proposing to do in the future in regard to atomic power. He highlighted his country's role in the supply picture and the fact that much is to be learned by the Belgians in the development field. The delegate from Italy, Giorgio Valerio, pointed out the difficulties facing Italy after the war in regard to nuclear development, and gave a brief picture of what was done over the years in spite of hardship and little funds. He went on to tell of the joint work between the government and private industry which is being done now.

• **OTHER TOPICS.**—Other topics which were explored in sessions of the conference included public safety and reactor operations, reactor designs for commercial power, use of radioisotopes in medicine and agriculture, economic factors in locating reactors, case studies of company planning and organization, and two radioisotope clinics, one each devoted to the process industries and the non-process industries, respectively.

• Warren Webster & Co. has announced a number of changes, effective October 11, 1954. A. Richard Webster was appointed vice president in charge of engineering and production. Theodore L. Webster was appointed secretary, succeeding his father, E. Kessler Webster, in this capacity. He will also act as assistant comptroller and continue to handle office and plant personnel. Dilwyn E. Senseman, cashier, was appointed comptroller and chief accountant. E. Kessler Webster continues as senior vice president and Andrew B. Young, junior vice president.

See This Sensational New Heating & Ventilating

GRILLE WITH DETACHABLE VOLUME CONTROL!

- Increased Directional Control
- Eliminates Possibility of Tampering or Accidental Changes
- Meters Air-flow Accurately

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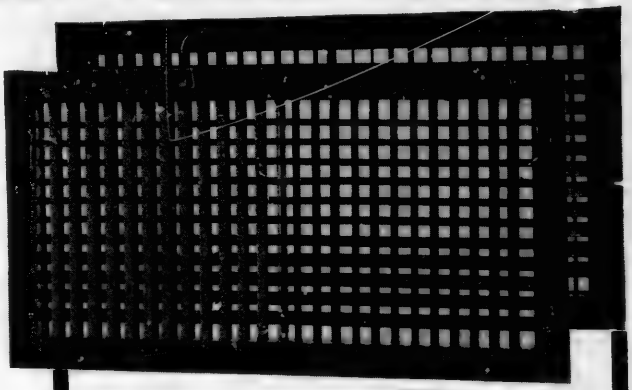
New features never before available . . . increased directional control, tamper-proof regulating, unmatched beauty, rugged strength and extreme ease of installation.
Extruded aluminum vanes are individually adjustable. Their unique shape provides greater directional control, and reduces air resistance to a minimum. This means more accurate balancing.
Each vane individually controlled. Operates under spring-loaded tension, eliminating any possibility of deflection pattern being altered by accident or tampering.
Fully-enclosed, wrap-around frame makes grille sturdier, assures easier, safer installation. Entire mechanism is concealed eliminating possibility of "air leaks."
Series "400" A-J Grilles (with or without volume control) available in any size. Choice of vertical or horizontal louvers only—or combination of both, with either louver in front. Both sets of louvers adjustable without removing grille. Available in prime coat, hammered bronze or metallic gray or any standard finish.



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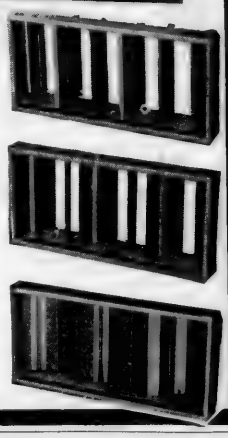

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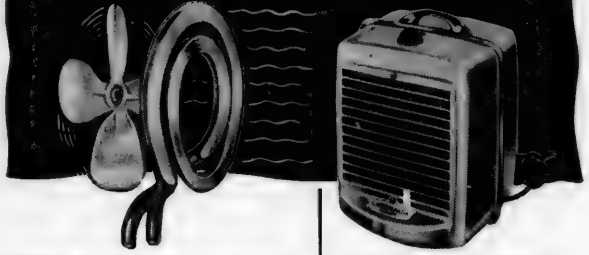

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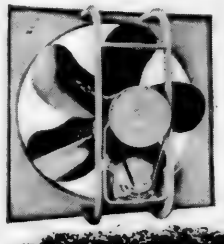
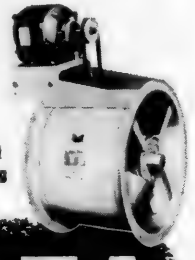


FOR GENERAL VENTILATION
Type IND



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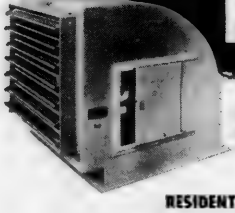
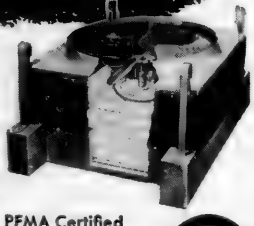


ROOF PENT-HOUSE UNIT
Type PH



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1. The names and addresses of the publisher, editor, managing editor, and business managers are:
Publisher, The Industrial Press, 148 Lafayette St., New York 13, N. Y.
Editor, Clifford Strock, 148 Lafayette St., New York 13, N. Y.
Managaing editor, None.

Business managers, Robert B. Luchars, Edgar A. Becker and Harold L. Gray, 148 Lafayette St., New York 13, N. Y.

2. The owner is:
The Industrial Press, 148 Lafayette St., New York 13, N. Y.; Robert B. Luchars, 148 Lafayette St., New York 13, N. Y.; Edgar A. Becker, 148 Lafayette St., New York 13, N. Y.; Franklin D. Jones, 148 Lafayette St., New York 13, N. Y.; Walter E. Robinson, 148 Lafayette St., New York 13, N. Y.; Charles O. Herb, 148 Lafayette St., New York 13, N. Y.; Harold L. Gray, 148 Lafayette St., New York 13, N. Y.; Clifford Strock, 148 Lafayette St., New York 13, N. Y.; Suno E. Larson, 148 Lafayette St., New York 13, N. Y.; Helena E. Oberg, 65-82nd St., Brooklyn 9, N. Y.; Edgar L. Becker, Nominee for Nancy Jane Becker, Susan Louise Becker and Donald Louis Becker, 370 Bedford Rd., Ridgewood, N. J.; First National Bank of Montclair and R. B. Luchars, Trustees (Beneficiaries Unknown), Upper Montclair, N. J.; First National Bank of Montclair and Leigh Roy Urban, Trustees (Beneficiaries Unknown), Upper Montclair, N. J.; First National Bank of Montclair and Kenneth D. Ketchum, Trustees (Beneficiaries Unknown) Upper Montclair, N. J.; Lee W. Noyes, Guardian for Susan Yarrall Urban, Greensboro, Vt.; Lee W. Noyes, Executrix of Will of Robert L. Urban, Greensboro, Vt.; John T. Urban, 224 Sullivan St., New York 12, N. Y.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are:
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4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

EDGAR A. BECKER, Business Manager

Sworn to and subscribed before me this 28th day of September, 1954.

ALEXANDER LOYKA

Notary Public, State of New York, No. 41-7611350. Qualified in Queens County. Commission Expires March 30, 1956.

Canadian Degree Days for October, 1954*

City	October		Cumulative	
	1954	Normal	1954	Normal
Calgary, Alta.	737	722	1209	1154
Charlottetown, P.E.I.	527	539	797	761
Crescent Valley, B. C.	744	698	1086	1058
Edmonton, Alta.	741	747	1161	1191
Fort William, Ont.	722	722	1149	1076
Grande Prairie, Alta.	787	812	1267	1292
Halifax, N. S.	412	499	608	688
London, Ont.	433	508	612	634
Medicine Hat, Alta.	617	601	952	868
Moncton, N. B.	539	595	854	877
Montreal, P. Q.	472	561	720	741
North Bay, Ont.	645	694	1032	958
Ottawa, Ont.	510	595	793	799
Penticton, B. C.	608	527	852	740
Porquis Junction, Ont.	778	800	1279	1196
Prince George, B. C.	790	741	1246	1185
Quebec City, P. Q.	589	651	925	927
Regina, Sask.	732	794	1146	1202
St. John, N. B.	527	558	845	828
Saskatoon, Sask.	710	781	1136	1177
Toronto, Ont.	375	504	525	672
Vancouver, B. C.	500	459	722	693
Victoria, B. C.	477	446	755	710
Windsor, Ont.	378	425	458	479
Winnipeg, Man.	704	744	1075	1074

*These data are supplied through the courtesy of the Meteorological Division, Air Service Branch, Department of Transport, Canada.

The Department reports slight revisions in the figures for September, as published in last month's issue. Corrected figures are: Charlottetown, P. E. I., 279; Crescent Valley, B. C., 394; Edmonton, Alta., 439; Grande Prairie, Alta., 492; Medicine Hat, Alta, 333; Prince George, B. C., 468; Regina, Saska., 444.

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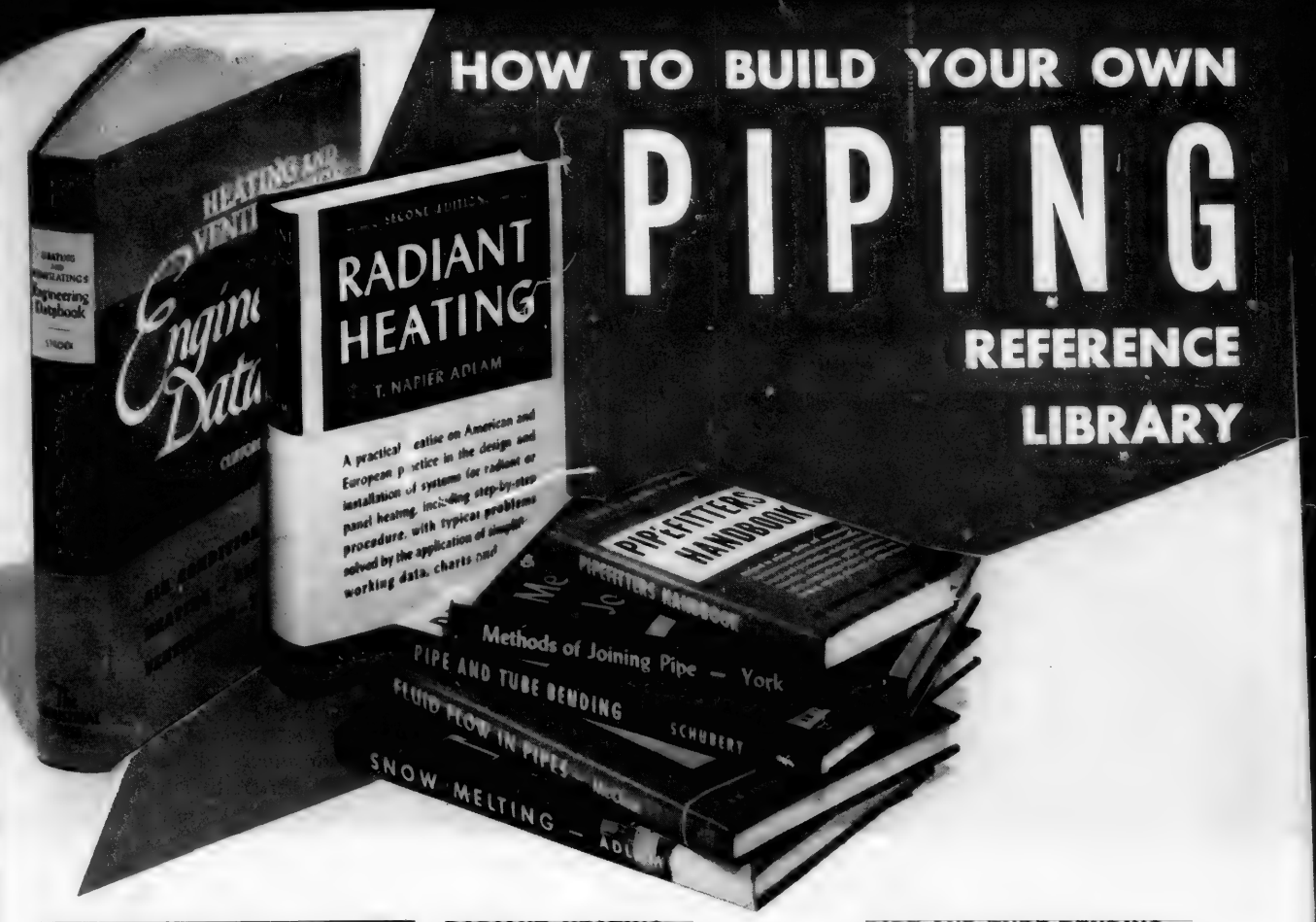

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London Letter

(*Concluded from page* 99)

mains pressure. The supply temperature of 300 deg F would be too high for these, but the cheapest arrangement was considered to be a temperature-controlled recirculating valve which causes to flow in the radiators a mixture of recirculated water together with a little fresh hot water straight from the HPHW main.

The swimming pool is 82 by 33 ft, 2 ft 6 in deep at the shallow end and 11 ft deep at the other. Round the pool, with basement, ground floor and two stories above, are arranged a number of rooms and baths for treating ailments such as rheumatism or merely for creating a sense of well-being. There are hot, dry rooms, medicinal baths with acid-resistant wall finishes, and rooms for radiation treatment, apart from the usual shower baths and changing rooms. There are also the necessary doctor's consulting rooms, waiting rooms, and offices for the health-center staff.

So as not to overload the heat-supply system, a stepwise technique for "warming-up" each morning has been worked out. The principle is to put heat first into those structures which have a large thermal capacity, and not waste heat in early-morning air which will have left the building before there is anyone there to breathe it. There is a significant dependence on natural ventilation, because the structure is favorable to it and it is almost impossible to avoid; the warming-up schedule therefore aims at delaying the heating of the volume of air above the bath for as long as possible. There are 24 diagrams in the paper, showing how various problems of peak loading or of mere construction have been solved.

Ample justification for this project on behalf of the 20,000 railwaymen (each of whom is expected to take a swim 5 days in the year) was to be found in the reliance that members of the public place on them for safe arrival at their journey's end. The health of these men is the concern of everybody.

Contrast is provided by the recent case in the Queen's Bench Division of the High Court of Justice when J. A. Murray successfully sued his former employers, Walnut Cabinet Works Ltd., for failing to heat the room in which he worked as a color and lacquer sprayer (*The Times*, Oct. 19). Ventilation was compulsory and there was a good draft through the shop with no heating and outside temperatures of 41 to 51 deg during October and November two years ago. Mr. Murray contracted pneumonia and pleurisy and was awarded damages of £402 against the firm. Their defense that they had got the piping but that there were delays in planning did not avail them.

COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

CHEMICAL ENGINEERS MEETING—47th annual meeting of the American Institute of Chemical Engineers, at the Statler Hotel, New York, N. Y. Secretary of the Institute, 29 W. 39th St., New York, N. Y.....**DECEMBER 12-15, 1954.**

(*Concluded on page* 154)

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No chart to change daily! One tape roll lasts almost a heating season. The HEAT RECORDER-TOTALIZER operates electrically — in any plant, large or small. Use it from job to job — or better yet, make it part of the installation . . . it's priced so low! *write for detailed literature A*

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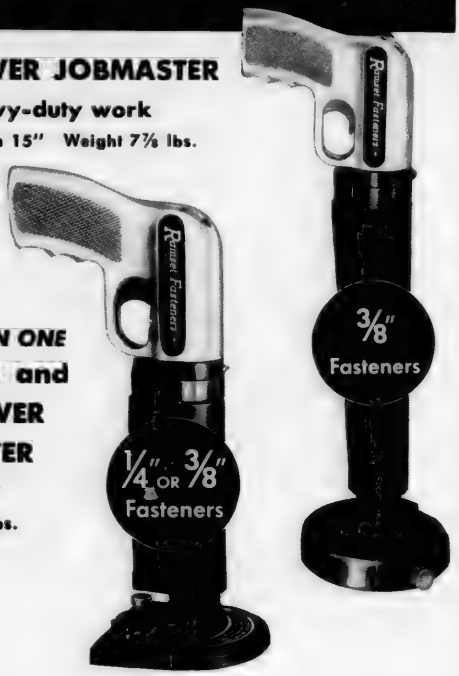

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(*Concluded from page* 152)

METEOROLOGICAL SOCIETY MEETING — 134th national meeting of the American Meteorological Society, at the University of California, Berkeley, Calif. Kenneth C. Spengler, executive secretary of the Society, 3 Joy St., Boston 8, Mass. . . . . **DECEMBER 28-30, 1954.**

NATIONAL RETAIL INDUSTRY SHOW—First National Retail Industry Show of the Store Modernization Institute, combined with the 5th Store Modernization Show at Madison Square Garden, New York, N. Y. John W. H. Evans, secretary of the Institute and managing director of the Show, 20 E. 55th St., New York, N. Y. . . . . **JANUARY 7-11, 1955.**

SOLAR ENERGY SYMPOSIUM—A world symposium on applied solar energy, sponsored by Stanford Research Institute, Stanford, Calif. at the Westward Ho Hotel, Phoenix, Ariz. Chairman of the Institute, 612 S. Flower St., Room 332, Los Angeles 14, Calif. . . . . **JANUARY 12-15, 1955.**

ASHVE MEETING—61st annual meeting of the American Society of Heating and Ventilating Engineers, at the Benjamin Franklin and Bellevue-Stratford Hotels, Philadelphia, Pa. A. V. Hutchinson, executive secretary of the Society, 62 Worth St., New York 13, N. Y. . . . . **JANUARY 24-27, 1955.**

HEATING & VENTILATING EXPOSITION—12th International Heating & Ventilating Exposition, at the Commercial Museum and Convention Hall, Philadelphia, Pa., held under the auspices of the American Society of Heating and Ventilating Engineers. E. K. Stevens, International Exposition Co., 480 Lexington Ave., New York 17, N. Y. . . . . **JANUARY 24-28, 1955.**

TESTING MATERIALS MEETING—1955 spring meeting of the American Society for Testing Materials, at the Netherland-Plaza Hotel, Cincinnati, Ohio. Secretary of the Society, 1916 Race St., Philadelphia 3, Pa. . . . . **JANUARY 31-FEBRUARY 4, 1955.**

INDUSTRIAL VENTILATION CONFERENCE—The 14th Annual Conference for bringing together plant engineers, contractors and others interested in industrial ventilation, is co-sponsored by Michigan Department of Health, Division of Occupational Health, and Michigan State College, School of Engineering. Held at Kellogg Center, Michigan State College, East Lansing, Michigan. James C. Barrett, Ventilation Engineer, Division of Occupational Health, Michigan Department of Health, Lansing 4, Michigan. . . . **FEBRUARY 14-17, 1955.**

CORROSION ENGINEERS CONVENTION—Annual convention of the National Association of Corrosion Engineers, at the Palmer House, Chicago, Ill. A. B. Campbell, executive secretary of the Association, 1061 N&M Building, Houston 2, Tex. . . . . **MARCH 7-11, 1955.**

OIL HEAT CONVENTION—33rd annual convention of the Oil-Heat Institute of America, tentatively set for the Conrad Hilton Hotel, Chicago, Ill. R. H. L. Becker, secretary of the Institute, 500 Fifth Ave., New York 36, N. Y. . . . . **APRIL 19-21, 1955.**

LUBRICATION ENGINEERS MEETING—Annual meeting and exhibit of the American Society of Lubrication Engineers, at the Hotel Sherman, Chicago, Ill. Wm. P. Youngclaus, Jr., secretary of the Society, 84 E. Randolph St., Chicago 1, Ill. . . . . **APRIL 13-15, 1955.**

MECHANICAL ENGINEERS MEETING—Spring meeting of the American Society of Mechanical Engineers, at Lord Baltimore Hotel, Baltimore, Md. C. E. Davies, secretary of the Society, 29 W. 39th St., New York, N. Y. . . . . **APRIL 18-20, 1955.**

GAS APPLIANCE MEETING—Annual meeting of the Gas Appliance Manufacturers Association, at the Ambassador Hotel, Los Angeles, Calif. H. Leigh Whitelaw, managing director of the Association, 60 E. 42nd St., New York, N. Y. . . . . **MAY 23-25, 1955.**

TESTING MATERIALS MEETING—Annual meeting of the American Society for Testing Materials, at the Chalfonte-Haddon Hall, Atlantic City, N. J. . . **JUNE 26-JULY 1, 1955.**

INTERNATIONAL CONGRESS OF REFRIGERATION—Ninth International Congress of Refrigeration, sponsored by the International Institute of Refrigeration, to be held in the conference rooms of the Sorbonne in Paris, France. General Secretariat of the Congress, International Institute of Refrigeration, 177, Boulevard Malesherbes, Paris, France . . . . . **AUGUST 31-SEPTEMBER 15, 1955.**

INSTRUMENT SOCIETY CONFERENCE—Tenth National Instrument Conference and Exhibit of the Instrument Society of America, to be held in Los Angeles, Calif. John McCaffery, assistant executive secretary of the Society, 1319 Allegheny Ave., Pittsburgh 33, Pa. . . . . **SEPTEMBER 12-16, 1955.**

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4. **LOW DRAFT CUT-OFF**—providing the safety of an integral minimum draft switch that shuts down firing at unsafe low draft limits. Time-delay feature prevents nuisance shut-downs due to momentary puffs.

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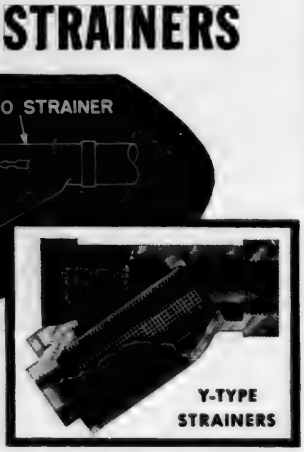

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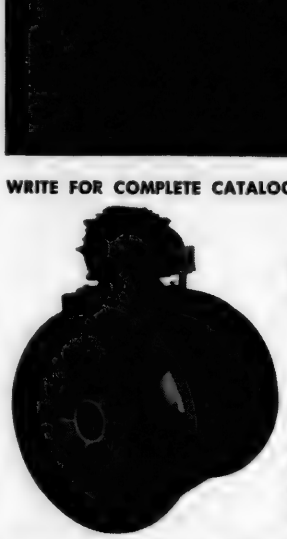

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RELATION OF AIR CHARACTERISTICS AND TEMPERATURE

The table below shows the effects of temperature on air volume, weight, and pressure, as well as power required to move the air, all based on air at 70 deg. F, for which the ratio is 1.00 in all cases.

Column (2) gives the relative volume of air of the same weight while Column (3) shows the relative velocities required to produce the same pressure. Column (4) contains the relative pressures required to pass the same weight of air through the same orifice and Column (5) the relative fan speeds required to move the same weight of air through the same orifice. Column (6) shows the relative power required to move the same weight of air through the same orifice. Column (7) is the relative power needed to move the same volume of air against the same resistance, Column (8) the relative power to move the same weight of air against the same resistance, and Column (9) is the power to move the same volume of air at the same velocity.

The chart is presented here by permission of American Blower Corporation from its publication "Air Conditioning and Engineering."

Temperature, Deg. F. (1)	Volume of Same Weight (2)	Velocity to Produce Same Pressure (3)	Pressure to Pass Same Weight (4)	Fan Speed, Same Weight (5)	Power, Same Weight, Orifice (6)	Power, Same Volume, Resistance (7)	Power, Same Weight, Resistance (8)	Power, Same Volume, Velocity (9)
0	.86	.932	.86	.86	.74	1.00	.86	1.15
10	.88	.942	.88	.88	.77	1.00	.88	1.13
20	.90	.952	.90	.90	.81	1.00	.90	1.10
30	.92	.961	.92	.92	.85	1.00	.92	1.08
40	.94	.971	.94	.94	.88	1.00	.94	1.06
50	.96	.981	.96	.96	.92	1.00	.96	1.04
60	.98	.990	.98	.98	.96	1.00	.98	1.02
70	1.00	1.000	1.00	1.00	1.00	1.00	1.00	1.00
80	1.02	1.009	1.02	1.02	1.04	1.00	1.02	.98
90	1.04	1.018	1.04	1.04	1.08	1.00	1.04	.96
100	1.06	1.028	1.06	1.06	1.12	1.00	1.06	.94
125	1.11	1.051	1.11	1.11	1.23	1.00	1.11	.90
150	1.15	1.073	1.15	1.15	1.34	1.00	1.15	.87
175	1.20	1.094	1.20	1.20	1.45	1.00	1.20	.83
200	1.25	1.114	1.25	1.25	1.56	1.00	1.25	.80
225	1.29	1.135	1.29	1.29	1.67	1.00	1.29	.77
250	1.34	1.156	1.34	1.34	1.79	1.00	1.34	.75
275	1.39	1.177	1.39	1.39	1.92	1.00	1.39	.72
300	1.43	1.197	1.43	1.43	2.06	1.00	1.43	.70
325	1.48	1.216	1.48	1.48	2.20	1.00	1.48	.68
350	1.53	1.235	1.53	1.53	2.34	1.00	1.53	.66
375	1.58	1.254	1.58	1.58	2.48	1.00	1.58	.64
400	1.62	1.273	1.62	1.62	2.63	1.00	1.62	.62
425	1.67	1.291	1.67	1.67	2.79	1.00	1.67	.60
450	1.72	1.309	1.72	1.72	2.95	1.00	1.72	.58
475	1.77	1.327	1.77	1.77	3.11	1.00	1.77	.56
500	1.81	1.345	1.81	1.81	3.28	1.00	1.81	.55
525	1.86	1.362	1.86	1.86	3.46	1.00	1.86	.54
550	1.91	1.379	1.91	1.91	3.64	1.00	1.91	.52
575	1.96	1.396	1.96	1.96	3.82	1.00	1.96	.51
600	2.00	1.414	2.00	2.00	4.00	1.00	2.00	.50
625	2.05	1.430	2.05	2.05	4.20	1.00	2.05	.49
650	2.10	1.446	2.10	2.10	4.40	1.00	2.10	.48
675	2.15	1.462	2.15	2.15	4.60	1.00	2.15	.47
800	2.19	1.478	2.19	2.19	4.79	1.00	2.19	.46
800	2.38	1.542	2.38	2.38	5.65	1.00	2.38	.42
1000	2.76	1.660	2.76	2.76	7.59	1.00	2.76	.36
1200	3.14	1.770	3.14	3.14	9.85	1.00	3.14	.32
1500	3.70	1.920	3.70	3.70	13.70	1.00	3.70	.27
2000	4.65	2.160	4.65	4.65	21.60	1.00	4.65	.21

HEAT EMISSION OF ANIMALS

In connection with air conditioning animal houses in research laboratories, veterinary establishments, and zoos, it is frequently desirable to estimate the heat load of various animals. Data on this are available but widely scattered.

It was known for many years that metabolism was a function of the surface area of the body and several different methods were proposed for determining this area; from the area, the metabolism was calculated.

However, the surface area is related to body weight, so that, knowing the weight, surface area could be determined. This appeared to be needlessly roundabout to Max Kleiber, of the University of California, who, in 1932, studied the direct relationship between body weight and metabolism. He demonstrated that, with reasonable accuracy, the basal metabolism of warm-blooded animals, from ring doves and mice to steers, including man, can be expressed by the equation

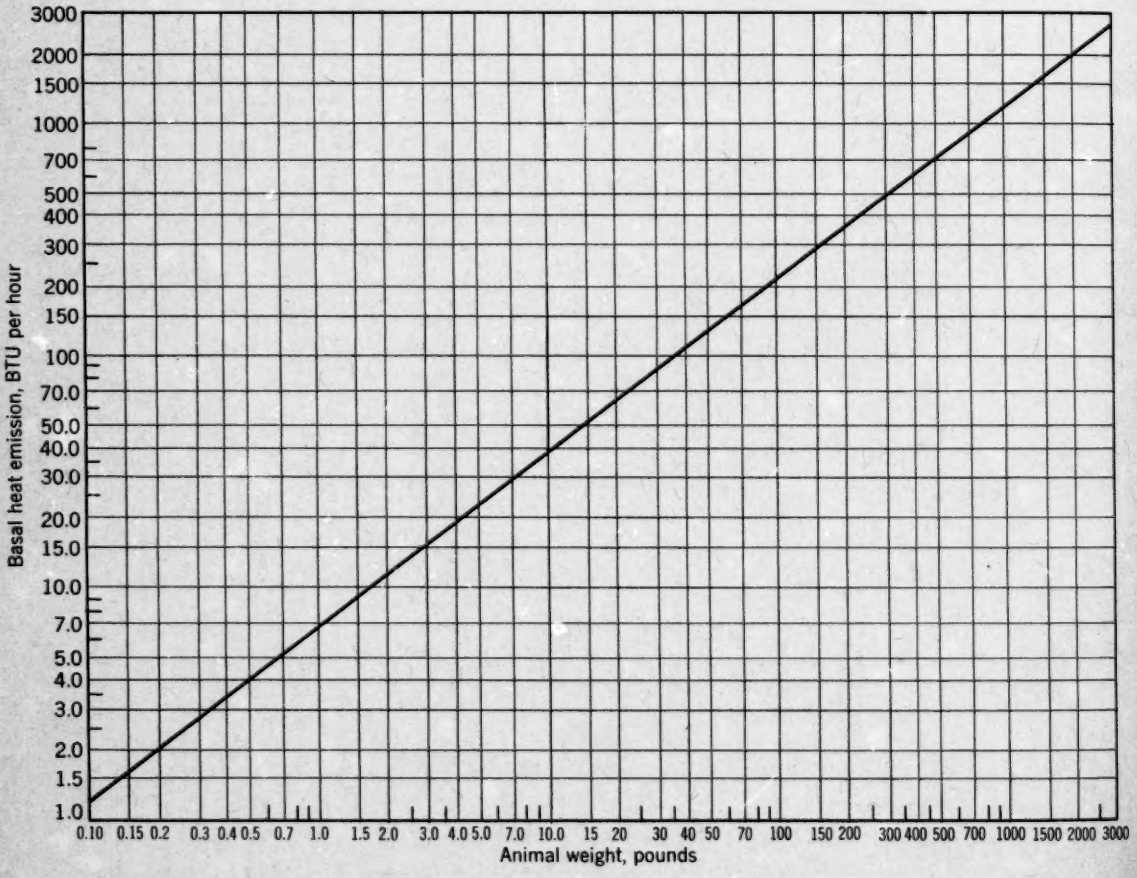
$$H = 6.6W^{0.75}$$

where H is the heat in Btu per hour per animal, and W is the weight of the animal in pounds. The formula applies to man as well as other animals.

The accompanying graph is a plot of this formula, so that, knowing the weight of the animal in pounds, the value of H can be read directly.

Since the basal metabolism is that for a state of utter relaxation, the figures read from the chart must be increased in proportion to the degree of activity of the animal. A multiplying factor of 2 is suggested for animals moderately active.

There are other variables affecting metabolism in addition to degree of activity. For example, Benedict showed that young men have a higher metabolism than old men, the decrease per year being 0.4% of the metabolism at 30 years of age. Further, although somewhat open to question, it has been stated that, due to radiation, dark colored animals have a higher metabolism than those of light color. For estimating purposes, however, these points have little bearing on the air conditioning engineer's problem.



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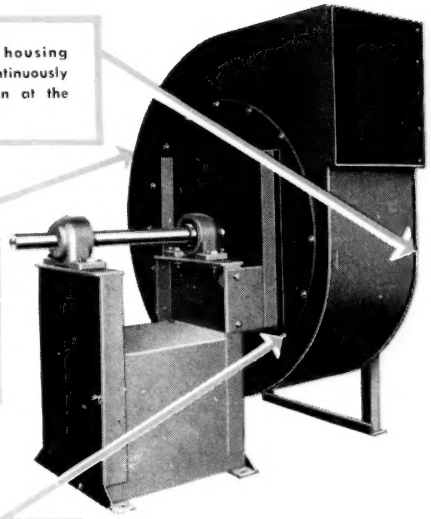
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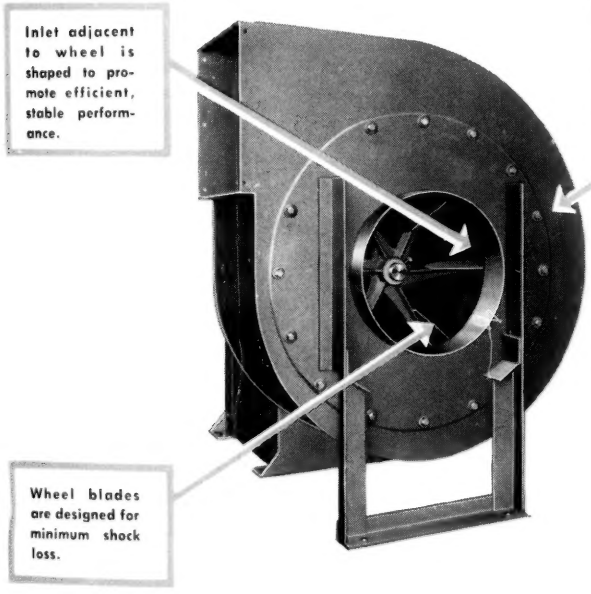
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Similar heating, ventilating and control arrangements apply to the gymnasium and auditorium. Again there are perfect temperatures when needed—rigid economy at other times.

Other spaces in the second wing—offices, corridors, locker rooms—are heated by direct radiation under the command of Johnson *Dual* Thermostats in each room. A special economy feature of Johnson *Dual* Control permits resetting each thermostat, from a central point, to maintain low, non-occupancy temperatures after regular school hours. Yet, if one or more rooms continue to be occupied, merely pushing a button on the thermostat restores that room to normal daytime temperatures. *Heating only the occupied areas results in large fuel savings.*

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